
I.—NATURAL AND ARTIFICIAL VESSELS. (*See p.* 6.)

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*A HANDBOOK TO THE CASES ILLUSTRATING STAGES IN*

# The Evolution of the Domestic Arts.

PART II.

## Basketry, Pottery, Spinning, and Weaving, etc.

(*Second Edition, 1924.*)

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## NOTE.

The first edition of this Handbook was published in 1911, and many requests for copies have been received since the issue was exhausted.

The present edition has been prepared by Mr. H. S. Harrison, D.Sc., F.R.A.I., by whom the first edition was written.

G. Topham Forrest,
Architect to the Council.

# PREFACE.

The present edition of this Handbook differs little from the first, except in the section dealing with pottery. In view of the extreme importance attaching to this vast subject, and of its intimate relationship to archæological investigation, it seemed advisable to attempt a rather fuller treatment of the methods of pottery-making amongst backward peoples, whilst giving also some points of contact with the more developed work of ancient and modern civilised potters. No one who is acquainted with the extent of the subject will expect more, in a book of this kind, than the briefest survey of methods, appliances, and results; it has been necessary, moreover, to omit discussion of many important topics, such as form, uses, designs used in decoration, the evolution of the kiln, and much else.

References to authorities are given as footnotes, and where the author's name appears with the page reference only, the work cited will be found in the book-list at the end of the Handbook. When the book is not in the Museum Library, and is therefore not in the list, the full reference is given in the footnote.

The Handbook is primarily intended to aid in the intelligent study of the Museum Collections, and it is hoped that it will render them more useful to those who are engaged in teaching or learning the fundamental principles of the arts and crafts with which it deals. The great modern industries of, for example, Lancashire and the Potteries, arose from such beginnings as are outlined in this Handbook, and no student can afford to neglect the origin and early evolution of the appliances and products to which he is giving his attention.

The collections with which the Handbook deals will be found in the South Hall of the Museum, in the section adjacent to that of Weapons of War and the Chase.

H. S. Harrison,
Curator.

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Iban (Sea-Dyak) woman of Sarawak, Borneo, weaving with rod-heald loom similar to that shown in the case (see p. 71). *Reproduced by kind permission of Dr. Charles Hose.*

# INTRODUCTION.

There are few domestic appliances that are so indispensable as the vessels used to hold food, liquid and solid. It is probable that the first such utensils to be used by man were in the form of natural receptacles, such as gourds and shells with the contents removed, employed for the carriage or storage of water. The progress of invention and discovery kept pace with man's need for a wider range in the form and nature of his food vessels, though many backward races are still using primitive utensils. Gourds, coconuts, shells, and skin-bags are employed by peoples who possess also such relatively advanced appliances as baskets, carved wooden vessels, and earthenware pots. Vessels of stoneware, porcelain, glass, and metal, are achievements of civilised man.

If food vessels are indispensable in woman's work, some form of cord or string is equally necessary for that of man. Nails are unknown to most uncivilised peoples, and lashing or binding takes their place. There are also many other purposes for which flexible cords are required. Whilst strips of animal hide, either as thongs, or twisted in strands to form rope, may be used when convenient and available, all races of men twist string or cord from plant fibres, and in rarer instances from hair or shredded sinew. An important part of the twisting process is often that of rolling the fibres along the thigh with the palm of the hand. The use of a short stick or spindle for twisting the fibre, a method known in Europe as early as the Later Stone Age, and still employed in many parts of the world, led on to the invention of the spinning-wheels of Europe and Asia. The yarn from the spindle is often made into string, as, for example, in parts of Australia, but the spinning-wheel is especially associated with the production of yarn for weaving, and the spinning-machine works to the same end. In spite of the complexity of the machinery involved in modern spinning, the spindle is still present, but numbers are worked together on one machine. Even here the twisting is performed by the revolutions of the steel spindles, and it is upon them, or the bobbins they carry, that the yarn is wound, as in the case of the primitive spindle of wood.

The dressing and curing of the skins of animals, for clothing and for other purposes, was practised at an early period in man's history, whilst the Eskimo of the Arctic regions, and many other modern peoples both in savagery and in civilisation, are furriers and tanners of varying degrees of skill.

Bark-cloth, a natural textile adapted for use by beating the inner bark of certain trees, is made in many parts of the world,

similar methods being employed in south-eastern Asia, Africa, Oceania, and South America.

In the evolution of textile fabrics, and of the appliances by which they are produced, the main line of advance passes from mats made by hand, through various inventions whereby hand-work was first made more rapid and more sure, and then in part superseded, in part re-inforced, by steam power and automatic devices such as are found in modern weaving-mills. The improvement of the appliances has usually led to the production of better fabrics, which may be turned out in vast quantities.

The principal arts and crafts considered in this Handbook, especially pottery-making, skin-dressing, bark-cloth making, spinning, and weaving, in many regions fall within the province of woman's work. This is not the universal rule, however, even amongst uncivilised peoples, and in various parts of the world any one of these activities may be carried on wholly or in part by men.

# HANDBOOK TO THE CASES.

## NATURAL AND ARTIFICIAL VESSELS.

Amongst uncivilised races the various kinds of utensils referred to in the Introduction, and described here in more detail, are made for use, though they frequently present ornamental features. In the higher stages of culture, vessels of earthenware, porcelain, glass, metal, and other materials also have many uses, but some forms are mainly or wholly ornamental. Objects of luxury such as these, as well as the great variety of bowls, dishes, plates, saucepans, and kettles of the modern kitchen, are the derivatives of the meagre outfit of the primitive household.

### Natural Vessels.

Centre Cases.]

#### Gourds, Coconuts, Shells, etc.

*Gourds.*—Owing to the abundance of gourd-producing plants in the warmer parts of the world, and to the ease with which serviceable utensils may be made from these fruits, gourd-vessels are more widely distributed than are any others of natural origin. Gourds of a desired shape may be obtained by tying a cord round the growing fruit. The preparation involves the removal of the contents through a hole in the rind, and the drying of the latter. The rind may be left entire and used as a bottle, or parts of it may be carved into bowls, cups, ladles, or spoons. Gourd-bottles are often protected by a net of string or fibre, such as is seen on the exhibited specimen from New Caledonia. In Southern Europe and Asia, in Africa, in Oceania, and in the warmer parts of America, gourds are extensively used, especially as water-vessels. In New Guinea and other parts of Melanesia they are often employed to contain the lime which is chewed with the betel (areca) nut, and in Africa they are sometimes used for powder-flasks. Gourd-vessels are frequently ornamented with carved, painted, or burnt-in designs, and they may have metal mounts.

*Coconuts*, though less widely distributed than gourds, are used as water-vessels in Africa, parts of southern Asia, and in the Pacific. The shell of the nut, after removal of the outer husk and of the kernel, may be left intact, except for the perforation that has already been made through one or more of the "eyes"; or it may be cut in half and the eyeless portion used as a cup, with or without a lid; or spoons and ladles may be made from portions of the shell. When the entire shell is used for carrying water a network of fibre may enclose it, as in the case of those with nets of sinnet, from the Fiji Islands. The outer surface

of the shell is frequently polished or carved, and in the Solomon Islands it is often inlaid with pieces of mother-of-pearl. In the same islands the shell is sometimes covered with hard gum, a bamboo tube forming a neck to the vessel.

The half-shell of a coconut is used for drinking kava in the Fiji Islands, and those used by chiefs or priests may have a flat handle of plaited coconut fibre. When coconut-shells are used as vessels in civilised countries such as Ceylon and Japan, they tend to become decorated so elaborately that they are ornaments rather than utensils.

Mention may be made here of the water vessels of *palm-leaf*, of which a specimen from Goaribari, New Guinea, is shown. A piece of leaf is bent and tied in the form of a bowl, and a handle for carrying is attached.

Pieces of *bamboo stem* are largely used as water-vessels in the Pacific, and in eastern Asia and its islands. They consist merely of one or more joints (or internodes), the bottom of the vessel being formed by a nodal partition which is left intact. Specimens from Burma and Sumatra are shown. (See also case containing specimens from the Andaman Islands.)

The *shells of molluscs* are the simplest of the natural vessels derived from animals. The *Nautilus* shell drinking-cups, the *Pinna* shell plates, and the *Cyrena* shell spoons, of the Andamanese are referred to in the first part of this Handbook. In the Torres Straits islands, lying between New Guinea and Australia, melon (*e.g.*, *Melo diadema*) shells are used as water-vessels, and for boiling food over the fire, and species of *Fusus*, *Cassis*, etc., are also used for water. Other shells have been found in use amongst races in simple conditions of culture, for spoons, ladles, bowls, etc.

By some peoples the *horns of oxen* are made into drinking-cups. Those of the Zulu of South Africa are made from horns that have been cut short on the young animal, and afterwards allowed to grow over and fill in the hole at the cut end. Sometimes such cups have a base flat enough for them to stand upon, but when the natural horns are used, as amongst our Anglo-Saxon ancestors, the horn must be emptied before being put down.

The use of horns may lead up to the working of the material itself, as amongst the Indians of the north-west coast of North America, who make dishes and spoons from the horns of the mountain-sheep, using steam to soften the material so that it can be properly shaped. Horn cups such as are shown were formerly extensively used in our own country, and modern specimens from Mexico and China are also exhibited.

*Ivory* drinking vessels are, or have been, objects of display amongst civilised peoples, and the cup made from the top of

a *human skull* (as in Tibet, for example), can scarcely be regarded as a domestic utensil.

The shells of *ostrich-eggs* were thus used by some South African tribes :—

"The dread of visits from Bechuanas of strange tribes causes the Bakalahari to reside far from water; and they not infrequently hide their supplies by filling the pits with sand and making a fire over the spot. When they wish to draw water the women come with a bag or net on their backs, in which are twenty or thirty ostrich egg-shells, with a hole in the end of each of the size of a finger. Tying a bunch of grass to one end of a reed about two feet long, they insert it in a hole dug as deep as the arm will reach, and ram the wet sand firmly round it. The grass absorbs the water, which is then sucked up by the woman through the reed. A straw goes from her mouth to one of the egg-shells on the ground, and, as she draws mouthful after mouthful from below, she makes the water trickle along the *outside* of the straw into the shell."*

In the same region the *shell of a land tortoise* is sometimes used to hold food or water.

## Artificial Vessels.

[Centre Cases]

### Skin Vessels.

The most primitive type of skin vessel is that in which a whole skin is used, and the Australian aborigines make use of more than one kind of animal for this purpose :—

"For the conveyance of water over long distances, water-bags used to be manufactured whenever and wherever this commodity was scarce . . . They were formerly made at Boulia, but what with the far better canvas water-bags obtainable from the whites, their manufacture both here and elsewhere has long ago ceased. They are as rare now in these particular districts as the complete stone-tomahawk. Made from kangaroo, paddymelon, or opossum, the skin is cut all the way round, high up in the neck, the front paws and tail removed close to their bases, and the whole skin pulled away inside out from the carcass : it is subsequently tanned with bloodwood gum. The front paw and tail-hole openings, together with those of the natural passages, are closed by means of a bone or wooden peg pierced through opposite edges, below which some strong twine or tendon is wound . . . Finally the two hind legs are tied together, so as to act conjointly like a strap which may either be slung over a shoulder or carried in the hand. What was once the neck of the animal forms now the mouth of the bag : the tanned side of the skin is inside." †

* Livingstone, p. 51 (condensed).

† Roth, W. E., 1, p. 102.

The water-seller of northern Africa carries an essentially similar vessel of goatskin, the hair being sometimes cut away in such a manner as to form a decorative design on the outside. The mouth of the vessel is at the neck of the goat, and may be strengthened with leather. An example from Cairo is shown.

The Eskimo and North American Indians employ skin vessels, sometimes made from the intestine or bladder of such animals as the walrus. A Blackfoot Indian bag, made of the skin of an unborn buffalo, is exhibited, and also a bucket made from the bladder of a walrus (Siberia). Bags or cases of tanned hide are used by the Indians to contain pemmican or other food materials. Fish-skin bags are used by some nomadic tribes of Northern Asia. Skin bottles and wine-bags from Africa, Spain, etc., are shown.

The old leather bottles and "black-jacks" of this country belong to the same series, though they are made of leather instead of imperfectly tanned hide. Specimens are exhibited.

A curious type of vessel is the decorated bottle from India, which is shown in the case. It is made by covering a clay core with pulped sinew and blood; when dry the clay core is broken and removed, and paper designs are glued on the outside of the bottle.

### Bark Vessels.

[Centre Case.]

The Australian aborigines provide us with another primitive type of vessel, in this case of bark: "A sheet of bark (tea-tree or other), the full size of the tree—so as to curl nicely—is removed, and its outer layer picked and peeled off with a kangaroo-bone stiletto: the two extremities, where the pleating subsequently takes place, are especially thinned and pared down with this implement, and finally warmed over a fire. Two superficial transverse cuts are now made on the inner side, at such distance from the extremities as to admit of the folds being bunched up on a common basis: this being done, the ends are again heated and the pleats fixed in position by skewering them through with a curved sharply-pointed 'iron-wood' peg. The inner surface of the bark constitutes the inner surface of the vessel."* The specimen exhibited is a tray rather than a bowl, and the ends are not skewered.

Bark vessels of a more highly-finished character were made by some North American Indians, and utensils of birch-bark are employed by the Gilyaks and other nomadic tribes of Northern Asia. A bark tray used for fish by the Ainu of Japan is shown in the case.

Mention may be made here of the bags or buckets made of seaweed by the now extinct Tasmanians. Each consisted of a circular piece of the plant (either *Fucus palmatus* or *Alga marina*),

* Roth, W. E., 3, p. 30.

shaped and tied or sewn in the form of a receptacle. When dried they could be used for obtaining or carrying water, and as drinking-cups. The water vessel of palm-leaf used in parts of British New Guinea may be again mentioned.

### Wooden Vessels.

Centre Case.]

Africa and Oceania are the two regions in which carved wooden dishes and vessels are most frequently employed in domestic life, though they occur in Asia, North America, and elsewhere, and have survived into modern times in civilised countries. The collection includes specimens from most parts of the world.

In Africa various forms of dishes, bowls, beakers, and cups are met with, and in Oceania shallow dishes and open bowls are the usual forms. In both regions, legs and handles are often present, and they are in one piece with the rest of the vessel. The outside is often carved with decorative designs, especially in Africa, and human or animal figures in relief, or in the round, are found on some examples. Shallow wooden trays and deep boat-shaped troughs are made by the Australian aborigines.

In addition to their uses for storing liquid food, such as milk, or as receptacles for preparing food or drink, as in the case of the kava-bowls of the Fiji Islands, wooden bowls may be used for cooking food. This is the case, for example, in the Solomon Islands, where large deep bowls, decorated with carvings and inlaid with mother-of-pearl, are used in the process of "stone-boiling." (See Part I. and Case 49 in the Decorative Art Section.)

The old wooden platters and bowls of this country, and the more elaborate Norwegian bowls, are examples of survivals of primitive utensils into civilisation. Our Anglo-Saxon ancestors made considerable use of ash-wood for food-vessels.

Vessels made of two or more pieces of wood fixed together are rare amongst uncivilised races, the most interesting forms being found amongst the Eskimo, and the Indians of north-west North America. The Eskimo make small wooden buckets of two pieces of wood, one, the base, being circular, the other, forming the sides, being a rectangular piece which is bent round so as to form a hollow cylinder, with the base closing one end. The two ends of the rectangular piece are sewn together where they meet and overlap. The Haida Indians and others make wooden boxes and chests, the four sides of which are of one piece of wood, bent at three of the angles, and pegged at the fourth, where the two ends meet. The old English harvest barrel and the modern cask are examples of wooden vessels made of several pieces.

Eskimo, Haida, Old English, and other examples of this class of vessels are exhibited.

## Stone Vessels.

[Octagonal Centre Case.]

Vessels carved or chipped in stone are rare, except for use as mortars, but cooking utensils of soapstone were made by the Indians of parts of North America, and by the Eskimo :—

"Every savage knows that stones heated and brought in contact with water are fractured hopelessly. But there is an exception to this rule in the class of rocks usually called soapstone, steatite, potstone. The aboriginal mineralogist, after scouring the earth, discovered this fact. All over Eskimo land both lamps and cooking pots are made of this material . . . . Quarries of soapstone, anciently worked, have been found in eastern North America, and in them not only fragments of broken pots, but the quartzite tools with which the quarrying and scraping out were done . . . But one must go to southern California, among the graves of the extinct tribes of the Santa Barbara islands and the mainland opposite, to get acquainted with a very dainty stone-working woman. The steatite pots of that region are almost globular, the mouths are only a few inches in diameter, and the walls are in many examples less than an inch in thickness. Many are capable of holding several gallons, and numbers of them show long-continued exposure to fire."*

The Ancient Egyptians of pre-dynastic times were wonderfully skilful in making bowls and jars from various kinds of stone.

An Eskimo soapstone kettle, Ancient Egyptian stone bowls and jar, and other specimens are exhibited.

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* Mason, 1, pp. 33-34.

# BASKETRY.

[Centre Case E.]

The art of basket-making was known in Europe at least as early as the Later Stone Age, and relics from the Swiss Lake Dwellings indicate that prehistoric man was already familiar with the chief technical methods used in the art. Of the origin and early development of basketry nothing is known. The interlacing of narrow bands or splints was perhaps derived from the methods of making huts and coarse wickerwork fences or fish-dams. The flat textiles known as mats are essentially similar to baskets in their technique (as are also many belts, armbands, and "straw" hats); it is possible that matting was the forerunner of basketry, and played a part in its origin. However this may be, "basketry and matting together constitute a most important division of savage invention. They are the one art that is more beautiful among the uncivilised. Enlightened nations express their æsthetic conceptions in lace and cloths and embroideries, the savage woman gives vent to her sense of beauty in basketry."* This is especially true of the Indians of California,† amongst whom basket-making was carried to a higher level of excellence than it has ever reached in any other part of the world.

Baskets are made by practically all peoples, savage or civilised, the materials used in their manufacture being the flexible roots, stems, leaves of plants, and splints or strands derived from these sources; animal products are rarely employed, except occasionally in decoration, or as straps for suspension.

Two chief methods of basket-making are practised, each having its own variations. In the one case the disposition of the elements is comparable with that of the warp and weft of woven cloth, and these are therefore called *woven* baskets, though no form of loom or frame is employed, and the work is usually done entirely with the fingers. In the other case, the foundation of the basket consists of a spiral coil, the turns of the spiral being sewn together, and these baskets are spoken of as *coiled*, or sewn. A bone or metal awl is usually employed in this method.

## Woven Baskets.

Woven baskets consist essentially of two sets of elements crossing one another, and so interwoven as to produce a coherent fabric in a definite form. In addition to variations which affect the shape of the basket, its nature and appearance depend upon the rigidity, thickness, width, colour, etc., of the materials used, and upon the exact method employed in combining them. Only the broad outlines of the subject can be given here, and for details the visitor should study the specimens exhibited—which

* Mason, 2, p. 228. † See James.

represent all the chief methods and include examples from all over the world—as well as the illustrated books and papers referred to in the list at the end of the Handbook.

1. *Wickerwork.* This method is the one used in making many of the common baskets in daily use in this and other countries. It is especially suited for the production of strong baskets for carrying heavy materials, and the simplicity of the method leads to cheapness of the product. Wickerwork is not necessarily coarse, however, as may be seen from an inspection of the specimens exhibited.

The general shape of a wickerwork basket is determined by the stiff rods which usually run from the centre of the base to the rim, and which may collectively be called the warp. The other elements, constituting the weft, are more slender and flexible, and are passed alternately over and under (in front and behind) the warp rods. In some cases, as in other methods of weaving, the weft elements may take two or more warp rods at a time; sometimes also the elements may consist of two or more rods or splints placed close together and treated as one.

2. *Wrapped-work.* In this case also the weft is more flexible than the warp, which determines the form of the basket. Each weft strand in passing across the warp takes one turn round each warp element. The method is known in America, and is also employed by the Andamanese, but it is not of any great importance in basketry.

3. *Twined-work or fitched-work.* "Plain twined weaving is a refined sort of wattling or crating. The ancient engineers, who built obstructions in streams to aid in catching or impounding fish, drove a row of sticks into the bottom of the stream a few inches apart. Vines and brush were woven upon these upright sticks, which served for a warp. In passing each stake the two vines or pieces of brush made a half turn on each other. This is a very primitive mode of weaving. Plain twined basketry is made on exactly the same plan. There is a set of warp elements which may be reeds, or splints, or string, arranged radially on the bottom and parallel on the body. The weft consists of two strips of root or other flexible material, and these are twisted as in forming a two-strand rope, passing over a warp stem at each half-turn."* The number of weft strands taken together may be more than two, and there are many modifications of the method by which twined basketry is produced. These cannot be described here in detail, but numerous examples will be seen in the case, and these will be found to be referable to one or other of the classes given by Mason :—

(*a*) Plain twined weaving over single warp elements (as described above.)

* Mason, 3, pp. 232-33.

(*b*) Diagonal twined weaving, or twill, over two or more warp elements. In this case the strands of the weft are twined round pairs of the warp elements, in such an order of succession that the ridges formed by the disposition of the weft run diagonally across the fabric.

(*c*) Wrapped twined weaving, or "bird-cage" twine. One of the two of each pair of weft elements passes along horizontally across the warp, usually on the inside of the basket; the other is wrapped round the crossings of the horizontal strand with the warp.

(*d*) Lattice twined weaving, in which there are four elements, (*a*) the vertical warp, (*b*) a horizontal warp crossing the vertical warp at right angles, (*c* and *d*) the pair of weft elements as used in plain twined weaving. Each element of the horizontal warp is wrapped and tied to the vertical warp at each crossing, by two weft strands, which are twined across in the ordinary way.

(*e*) Three-strand twined weaving, in which there are three instead of two weft elements in each set.

Although in its simplest form twined basketry appears to be nearly related to wickerwork and its probable predecessors, no other style of technique has so many variations. Like coiled basketry also, it may be made of such close texture that the basket will hold water, as in the case of many examples from western North America. In one form or another the method is found in most parts of the world, and it is an argument in favour of its relatively primitive nature that no other method of basket-making appears to have been known to the Tasmanians, who are usually recognised as having been lower in the scale of culture than any other modern race of man.

4. *Chequer-work.* When the warp of a wicker-work basket differs very little from the weft, the chequer-work type may be nearly approached, and in some cases it is impossible to say to which group a particular basket should be assigned. In chequer-work, warp and weft are similar in character, and they are interwoven in the simplest possible way; if they are made of elements similar to each other in every respect, and if the weaving is close, the squares or rhomboids seen on the surface are all equal and similar. If the elements cross at right angles, and if the warp is all one colour and the weft another, a draughtboard pattern is produced. Other variations depend upon the relative width of the elements, the angle at which they cross, the use of several colours, and upon minor variations of technique. Chequer-work is often found in association with other methods, especially twilled-work, in the same basket.

5. *Twilled-work.* In this technique the weft elements are passed over and under two or more warp elements at a time. When the method is applied uniformly the effect produced may

be that of diagonal lines or bands across the basket, but great variety may be introduced by making changes in the number of warp elements passed over and under by the strands of the weft. In this way, and also by the use of variously coloured elements, highly decorative effects may be easily produced. Twilled basketry is found in most parts of the world.

Although the methods used in woven basketry may, one or more of them, be identified on most baskets of this class, the possibilities of variation and combination are so numerous, especially in twined-work, that it is only by a close study, and sometimes only by dissection, of the baskets themselves that the subject can be properly understood. As regards ornamentation also, the many geometrical designs, and the representations of human, animal, and plant forms, depend upon combinations that it would be hopeless to attempt to describe without the aid of numerous figures.

### Coiled Baskets.

The technique of coiled basketry differs entirely from any of the methods described above. The process of manufacture, as carried on by the Indian women of California, may be regarded as typical :—

"The elements are a stiff root or rod for the fundamental coil, and a soft splint or strip of the same material for the sewing. In making her basket, the woman starts in the centre of the bottom, coiling the rod and wrapping it as she proceeds with the split root or rattan, so as to bind it to the preceding turn, drawing her splint between the spirals. When the rod comes to an end, she neatly splices the end to that of a new one and proceeds as before, carefully concealing the joint. When the splint [for sewing] is exhausted, the end is tucked in behind the spiral and another one started in the same manner, but so carefully joined as to defy detection."*

In coiled baskets the spiral course of the foundation is usually conspicuous, but the rod itself is often entirely hidden by the sewing. The rod may be single, or it may be represented by two or more thinner rods, or by a large number of fine strands, though it may be impossible to detect its nature without dissection. The stitches in each row usually interlock with those of the rows above and below, but in some baskets they pass through the material of stitches already made. Basing his classification upon the relationship of the stitches to each other and to the simple or composite foundation, Mason† institutes no fewer than ten types of coiled basketry. It is not possible to discuss these types here, nor can the methods of ornamentation

* Mason, 2, p. 235.

† Mason, 3, p. 246.

be considered. One kind of decoration calls for mention, however, since it results in the concealing of the stitches to such an extent that an uncritical examination of the basket might fail to reveal the nature of the technique. Mason applies the term "imbricated" to this kind of work, which consists in the covering of the basket, along the lines of the foundation, with broad strips of coloured bark, bast, or grass. "The strip of coloured bark or grass is laid down and caught under a passing stitch; before another stitch is taken this one is bent forward to cover the last stitch, doubled on itself so as to be underneath the next stitch, and so with each one it is bent backward and forward so that the sewing is entirely concealed, forming a sort of 'knife plaiting.'"* The method is especially characteristic of some Indian tribes of the north-west coast of North America.

The best examples of coiled work are found in Africa (Somali, Barotse, and other tribes) and North America, but the method is practised also in Australia, China, and elsewhere. Coiled baskets, like those made in twined weaving, are sometimes constructed to hold water, and may even be used for cooking food by the stone-boiling method. Pitch may be applied to lessen the risk of leakage.

† Mason, 3, p. 255.

# POTTERY.

Centre Cases.]

In spite of the fragility of vessels of earthenware and porcelain, the nature of the constituent material is such that it is very resistent to the disintegrating action of natural solvents and variations of temperature. Because of this same fragility, on the other hand, pots are easily broken, and need frequent replacement. Potsherds are, therefore, amongst the commonest surviving relics of the arts and industries of past times, historic and prehistoric, whilst great numbers of entire vessels of great antiquity have been found in various parts of the Old World. Since fragments of pottery are of no value to the tomb-robber and the uninstructed collector, they may remain upon their original site till they are discovered by the archæologist, who can interpret the evidence they offer. From the nature of the pottery and its decoration, if any, reliable inferences may be drawn as to the state of culture of the makers, and as to the progress—not only in pottery-making, but also in other directions—made during the period covered by the finds. Light may be thrown upon problems of sequence and chronology, and of culture contacts and transmissions.

The essential constituent of all pottery is one or other of the natural plastic clays, since these alone possess, in any marked degree, the property of being "kneadable," and of becoming converted by a moderate degree of heat into a hard and durable substance. In composition, every form of pottery consists mainly of a mixture of silicates of varying composition, that of aluminium predominating. Iron, soda, potash, and lime are often present in small quantities, and may play an important part in determining the character and appearance of the ware. Some natural clays are liable to excessive contraction in drying or firing, owing to the tenacity with which they retain water, and it is a wide-spread practice to add sand, ground potsherds, or other tempering materials to prevent the vessels from cracking in the fire. The added material loosens the texture of the clay and so enables the water to escape more readily; in some cases, also, it renders the clay less liable to fusion, and consequent distortion, in the heat of the fire. Many clays contain sufficient free silica, in the form of sand, to require no tempering.

Iron occurs in all common clays, very generally in the form of ferric oxide, of which a proportion of about 8 per cent. is frequent. As will be seen later, the iron is affected during the firing process in such a way as to play an important part in the colouring of the finished ware. Even the whitest clays, such as kaolin, or China clay, are not absolutely free from iron. Light-coloured clays have been sought for by the potter since very early times, though it is only the civilised potter of relatively modern days

who has made extensive use of them for the body of his wares. The primitive potter, civilised or not, usually saves these precious whiter clays for decorative use.

Potters' clay may be dried, in a hot sun or otherwise, till all the free water is evaporated out; it then loses its plasticity, and becomes hard and brittle. The plasticity may, however, be restored by mixing and kneading with water. But if the clay is fired to a red heat—as in the baking even of primitive pottery—of 400 to 500 degrees Centigrade, the chemically-combined water is also driven out, and there is then no means by which the plasticity can be restored.* Hence it is that ancient pottery may be broken into small pieces, but it cannot return to its original form of plastic clay.

Sun-dried bricks or pots are merely clay with the free water removed, and they can only be used in a dry climate, or for restricted purposes. Thus the Kabyles of North Africa have huge pots of unbaked clay, several feet in height, which are used to hold grain, and are kept inside the house.

The chief applications of primitive pottery are, of course, in domestic life, in which vessels are required for holding food, and for use in cooking, eating, drinking, etc. Earthenware vessels, often containing food, have frequently been deposited along with the dead, and have also been used to contain the body or ashes of the deceased. Toys, whistles, tobacco pipes, and other small objects, are not infrequently made of earthenware, but purely ornamental pottery scarcely appears outside civilisation.

From the standpoint of the primitive housewife the feature that makes pottery so much more useful than vessels of other materials, is that it does not burn when placed on or near a fire, for cooking purposes. For holding food of some kinds, also, pottery is cleaner than vessels of wood, bark, basketry, etc.

Pottery-making is best developed amongst sedentary peoples, and it may be little practised, or entirely absent, amongst hunting and nomadic tribes, who make use of utensils of skin, bark, and basketry, which are less liable to breakage during transport. Pottery is, however, made by most races of man, and, in time, the art extends back far into the prehistoric Stone Age. The aborigines of Australia and of Tasmania appear to have never made pottery, and the Polynesians had either lost the art when they spread over the Pacific, or had never known it. In some areas, such as New Guinea, some tribes make pottery, whilst others do not, and pots are traded from one district to another. It is—or was—in North and South America that the develop-

* The basis of all clays, *Kaolinite*, is a hydrous silicate of alumina, *i.e.*, a chemical combination of the silicate with water. It is this "water of constitution" that is only driven off by the heat of the fire. Some other ingredients or impurities of clay are also hydrous compounds, and lose their water during firing. This is the case with the mica which (together with Kaolinite as the main constituent) occurs in Kaolin, and in other clays.

ment of pottery-making without the wheel reached its highest level outside the Old World, and indeed, the best products of the Indian potters of Central America and Peru challenge comparison with those of the ancient Old World civilisations of the Eastern Mediterranean area.

It may be noted that the primitive potter is often, though by no means invariably, a woman, and that in some cases pottery is only made by particular families or castes.

## The Origin of Pottery.

There is little doubt that pottery was a later invention than basketry, and that man was familiar with various other kinds of vessels—gourds, skins, etc.—before he discovered the properties of clay. There is some probability that the first vessels of this material were made by plastering it on the inside of bowls or trays of basketry or gourd-rind, and that the independence of the clay vessel was a later development. The pottery made by former generations of North American Indians presents many indications of such methods of shaping the clay, and there are observations made even as late as the first half of last century which show that the method had not then become obsolete :—

"In the construction of those [pots] of large size, it was customary to model [mould] them in baskets of willow or splints, which, at the proper period, were burned off, leaving the vessel perfect in form, and retaining the somewhat ornamental markings of their moulds. Some of those found on the Ohio seem to have been modelled [moulded] in bags or nettings of coarse thread or twisted bark. These practices are still retained by some of the remote western tribes."*

Excellent examples of markings on pottery produced by imprints of netting, cloth, and basketry, have been recorded from the Mississippi Valley and elsewhere, but it is clear that many of these imprints were done after the shaping of the pot, and are not due to the use of baskets or bags as moulds.

The manner in which a clay lining to a vessel of another material may result in the production of an earthenware dish, is exemplified by a practice of the Coconinos Indians of Arizona, who roasted seeds, crickets, bits of meat, etc., in wicker trays coated inside with clay, which was pressed in whilst soft and allowed to dry. The food to be roasted was placed on the tray, together with glowing wood-embers, and the tray shaken to and fro, with constant blowing to keep the embers burning. The food was thus cooked, and incidentally the clay became baked. Such a practice might readily lead to the manufacture of open clay vessels for intentional baking. It is easy to suggest other

*Squier and Davis, Ancient monuments of the Mississippi Valley, quoted by Tylor, p. 272.

theories as to the origin of pottery, but in any case it has developed in close association with baskets and other vessels, especially as regards form and ornamentation. The latter is often based upon basket-work or string-work, and the form is frequently that of a gourd or other utensil, though at the present day the similarity is due to imitation, and not to the practice of the moulding (or coating) method.

## The Essentials of Pottery-making.

The shaping of a plain piece of pottery may be done with the hands alone, and for converting the plastic clay into the hard and brittle earthenware, an open wood fire may suffice. There is usually, however, at least a little elaboration of this simple procedure, since the clay may need to be freed from pebbles, and mixed with water and with tempering substances, whilst the hand may be assisted by a few simple tools. Drying of the clay, also, must precede firing, if the walls of the vessel are not to burst in consequence of the rapid liberation of water; after shaping, therefore, the pot is dried, in the shade, in the sun, within a hut, or by means of a fire, according to circumstances. By this means most of the free water is removed from the clay, and the pot becomes hard enough to handle, either for completion, or for the addition of ornament.

By most backward peoples the firing of pottery is done in the open, in fires which are made from ordinary combustible materials such as branches, twigs, leaves, grass, dried dung; the fuel chosen is, however, not necessarily that which is nearest to hand, but may be of a special kind which has been found to give the best results. Fuel is often laid as a bed for the pots, and when they are in position it is heaped above and between and around them. In some cases the heap is covered with heavy slow-burning fuel, so that the heat is kept within the fire. Occasionally the fire is made in a shallow trench or pit, and provision is made for creating a draught; bellows may sometimes be used for this purpose. Kilns are rare amongst the appliances of the primitive potter, though simple forms are in use in parts of the Belgian Congo. Many vessels may be baked together in one fire, but not uncommonly one pot, especially if it is of large size, may have a fire to itself.

It is obvious that the open-fire method of baking pottery must lead to considerable variations in the condition of the finished ware, since so much hinges upon the temperature and duration of the firing. Much depends also on the knowledge and skill of the potter, and upon the importance that is attached to the making of durable and artistic vessels. Primitive pottery may be very soft, as a result of insufficient firing, and it often gives evidence that the firing was neither intense nor prolonged. It

is usually porous, and various methods of correcting this defect are practised.

Dismissing for the present all questions of form, composition, and ornamentation, and excluding also advanced methods (such as casting) developed in modern manufactories, pottery may be divided into two main classes, *hand-made* and *wheel-made*. All pottery made by the native races of Africa (except in Egypt and here and there elsewhere), as well as of the Pacific and of America, is made by hand, and the wheel has never been known to these peoples. In Europe, Asia, and parts of North Africa, the potter's wheel has been in use for many hundreds of years, in Egypt as long ago as the Fourth Dynasty (*i.e.*, about 3000 B.C.). Nevertheless, the making of pottery by primitive methods, and without the wheel, has survived in outlying or secluded parts of these regions. In our own country the wheel was not known till the Early Iron Age, and long after this period the Anglo-Saxons were making pottery in Britain without its aid. It must be noted, also, that the method of moulding is not confined to potters ignorant of the wheel; on the contrary, it has survived as a modern method of making various common utensils, such as plates, dishes, and other vessels whose form is more easily arrived at by pressing a sheet, or "bat," of clay into a mould. In this Handbook the term "hand-made pottery" is used for pottery made by peoples or tribes to whom the wheel was, or is, unknown; "wheel-made pottery" covers the wares made by wheel-using peoples. (For the *tournette* and the developed wheel see p. 42.)

The earliest European pottery is that of the Neolithic Age, and the supposed examples of Palæolithic pottery have not met with any general acceptance.

## Hand-made Pottery.

In America, Oceania, and to a less extent in Africa, the intrusion of an alien form of culture has led to the disappearance, or at least the degeneration, of many native arts and crafts. In so far, however, as parts of these regions have resisted the civilising and disintegrating influence of the white man, there still remain survivals of the indigenous cultures, whilst there have also been preserved many records of observations made by early discoverers and travellers. In the case of pottery, as in other arts and crafts, much has been learnt from the study of specimens that have been obtained by excavation. In America, in particular, the hand-made pottery of the old civilisations that extended from Mexico to Peru, has been studied in great detail, whilst the more modern products have not been neglected. In the Melanesian islands of Oceania archæology has few opportunities, but there are many recent observations of value,

and pottery is still made in some islands. In savage Africa, also, the art is widely practised, and even in the north the production of hand-made ware may be studied. In Asia the wheel is predominant, but the earlier methods are not entirely extinct; relatively little is known of the ancient pottery of Asia, except in parts of the west. In Egypt and in Europe, on the other hand, the archæologist has reaped an abundant harvest from his study of the early developments of the technique and designs of the potter.

In giving an account of methods of manufacture, it is necessary to rely almost entirely upon recent observations of the procedure of primitive potters, since it is only exceptionally that a finished vessel gives reliable clues as to the method by which it was made. In any case, it is obvious that it is of the greatest importance to apply the knowledge gained from the study of modern primitive methods to the interpretation of the wares produced by the craftsmen of ancient civilisations.

Although no wheel is employed in the shaping of the pottery with which we are at present concerned, it is a very widespread practice to begin the process in the base of a broken pot, or upon some other support which permits of slow rotation, so that each part of the embryo vessel can in turn be brought into a convenient position for manipulation. It is probable that in some part of the Old World this practice gave rise to the invention of the potter's wheel (see p. 42.).

Other appliances used by the potter are of extreme simplicity, and comprise such implements as shells or pieces of gourd for scraping and smoothing, flat sticks or paddles for pressing and patting, stones for modelling and polishing, and similar tools. Implements for use in adding ornament are often equally simple.

It is difficult to classify the methods used in shaping the clay, without setting up more definite boundaries than actually exist. As will be seen, also, more than one method may be used on the same vessel. Subject to these qualifications, the following sub-divisions may be made :—(1) *moulding*, (2) *modelling*, and (3) *building*.

Before discussing some examples of the above methods, it is desirable to refer to processes which may play a part in any of the three. In shaping and smoothing clay it is necessary that the material should not be allowed to dry too rapidly during the work, lest it lose its plasticity. For this reason water is usually kept at hand, into which the potter's fingers are dipped when needed—not only to moisten the clay, but to keep it from adhering to the hands. When the vessel is being constructed from portions of clay added at intervals as the work proceeds, it is especially necessary that the clay should be soft enough for these additions to be forced into thorough cohesion by

pressure and beating; ornaments and handles must also be fixed on firmly before drying takes place. For this purpose, recourse may be had to a batter-like mixture of fine clay with water, the consistency of this mixture varying with the nature of the work. The use of such a clay "gruel" as a cement for handles or ornaments may have led to the origin of the "slip" which so often plays an important part in the decoration of pottery (see p. 36).

### Moulding.

The method of moulding, to which reference has already been made, is not in frequent use amongst modern backward peoples, except in so far as the base of a pot may have its beginnings in a concave support such as the bottom of a broken vessel. The several methods employed by the Hausa* in Northern Nigeria, include one which is mainly that of moulding. The clay is kneaded into the shape of a large thick pancake, 12 in. in diameter and 1 in. or more in thickness, and is then spread over an inverted pot, to which it is moulded with the hand and a piece of wood. After drying for some hours, the clay-dome—which is not moulded to the neck and mouth of the inverted pot—is removed, and the inward curve at the neck is produced by modelling with the fingers and a beater. The mouth is then finished off with a roll of clay, which is shaped with the fingers. There are a few other recorded examples of the use of the moulding method in Africa, in one case the pot being built up from parts that have been moulded separately. The use of this method in North America has already been mentioned; in addition to baskets, gourds and blocks of wood were sometimes employed. The potters of Ancient Peru made extensive use of moulds, sometimes for whole vessels, sometimes for parts which were "luted" together with slip before firing.

### Modelling.

In modelling, a "lump" of clay is shaped by hand, usually aided by some simple tool, to the form of the future pot. In some cases a little moulding of the base may occur, and the mouth may be finished by means of an added roll of clay, but the essential feature of the method is that practically the whole of the pot is modelled by hand from one lump of clay.

The method of modelling is generally distributed, and only a few examples can be given. In British Central Africa:—

"The women, having procured the right kind of earth, break it up on a stone and knead it with water till it attains the proper consistency; then they mould [model] a round lump, make a hole in the middle and work away at it with their hands and

* Tremearne, p. 103.

now and then a bamboo splint. No wheel or mould is used. Sometimes an incised pattern is made while the clay is soft. When finished, the pot is stood in the shade for a day ; then they put it out into the sun, and when dry, burn it in an open wood fire . . . Pots not expected to stand the fire are considered fit for use after drying in the sun, and will hold water satisfactorily though apt to grow soft if kept continuously wet."*

As an example of the modelling of pottery in a region (Nubia) which has long been in more or less continuous contact with Egyptian civilisation, the following may be quoted :—

"The first thing to be done is to knead the clay. This, as has been already stated, is merely Nile mud mixed with a certain proportion of pounded fragments of old potsherds. A lump of the mud dough is placed upon a wide bowl filled with ashes which have been slightly damped. The lump is of such a size as will suffice for the making of the entire vessel, be it bowl or pot. . . Taking a little water, the potter presses a hollow in the middle of the clay lump and begins to form it into shape, holding the outside of the growing vessel with her left hand and shaping it with her right. From time to time she twists the bowl of ashes from left to right in order to bring another part conveniently beneath her hand, and pulls the clay outwards from the middle of the lump to form the rapidly rising sides. With a little water she moistens the surface every now and then as it is required. The rudimentary bowl will now be 2 or 3 inches in depth, its centre hollowed out but its sides still vertical and thick. The sides must next be heightened and thinned, to do which the potter takes a large shell of a common Nile variety and strokes the outer surface of the bowl upwards, producing at the same time the first indications of a curve in the section of the side. Then she shapes the interior still more with the right hand, and smooths the top surface to make the rim. Lastly, she smooths the interior also with the shell, and at the same time imparts to the sides the full convexo-concavity of a finished bowl." The clay vessels are then left to dry for ten days in the open air, and the outside of each is coated with hæmatite, powdered and mixed with water and a little olive oil ; this coating is burnished with a smooth oval pebble, and it serves not only to make the finished pot less porous, but to give it a bright red surface (see p. 37). "Finally, if the vessel is to be permanent, the soft clay must be hardened in the fire, a process which also takes place in the open air. The pots are piled within a ring of stones about 3 ft. in diameter, over which the fuel is heaped and left to burn itself out."†

Amongst the Berbers of Algeria, the Chawia women make their pots entirely by the modelling method, their tools being

* Werner, pp. 204-5. † MacIver, p. 21.

a flat piece of wood for beating the outside, and a smooth stone for pressing and rubbing the inside. Gum is used to varnish the pot, or it may be applied so as to form a decorative design. In some parts of New Guinea the modelling method is employed, with the aid of tools—a paddle-shaped wooden beater and a smooth stone—essentially similar in type and use to those of the Chawia women.

**Building.**

Under this heading may be included the shaping, or completing from the base upwards, of a pot which is not modelled from one lump of clay, but is built up from two or more pieces. These initial pieces may be of various forms, and in many cases the process of construction depends largely, or entirely, on the use of rolls or pencils of clay, short or long. These may be used in a manner which is distinguished as *coiling* (see below), and this is the most widespread and distinctive of the building methods. It may have been derived from, or influenced by, the method of making coiled basketry.

A Handbook of this kind is not the place for a discussion of the probable inter-relationships of the various methods of shaping pottery by hand. It should be noted, however, that the methods given here under "Building" are only grouped together for convenience. In some cases the basis of the process is clearly modelling, whilst in others moulding and coiling may be involved.

Near Lake Tanganyika, in Africa, the Bagua women start making a pot from a thick ring of clay, which is modelled to the form of a pot without a bottom, this being added at the finish; for larger pots, two rings of clay, one on top of the other, form the material for modelling. Specimens obtained to illustrate stages in the process are shown in the case.

The following may be given as an example of work which may be restricted to modelling, or which may combine this process with building up with rolls of clay :—

The Akikuyu of East Africa,* amongst whom the pottery is made by the women of a few special families, have an unusual method of shaping a pot. The clay is made into an oblong slab (say, 10 in. by 4 in., and 2 in. thick), which is then curved round so that the two ends meet to form a short hollow cylinder or collar; this is placed upright, and pressed downwards so that the base is squeezed to form a thick rim. By pressing and scraping upwards, the collar is shaped in the form of the neck and mouth of the future pot; if additional clay is necessary for this process it is supplied in the form of thick rolls. After drying till the clay can be handled, the partly modelled vessel is turned

* Routledge, pp. 100-102.

the other way up, and the base of the pot is formed by drawing out the clay of the thick rim already mentioned, which has been carefully kept moist. It may be noted that if the pot is a large one, two or more slabs of clay may be joined up, end to end, to form the initial collar.

It is interesting to record that the Sema Nagas of Assam* also shape the greater part of a pot from a rectangular slab of clay bent round to form a cylindrical collar. In this case the collar is, however, placed vertically on a circular slab of clay which is to form the base of the pot. The clay is joined at the two seams, and the pot is given its final shape by beating the outside with a small wooden bat covered with string, whilst the left hand is at work inside the pot. Obviously related to this is the Manipur Naga method of wrapping a sheet of clay round a bamboo stem to obtain the cylinder from which the pot is shaped.†

On the Blue Nile,‡ pottery is made by the native women with the aid of a shell from the river and a rounded stone. A local brown clay is used, and it is tempered with donkey's dung. A depression is made in a large lump of clay with the stone, and the hole is enlarged by using the stone as a beater. Gradually the wall is reduced to the right thickness, and there is produced an open bowl, which narrows slightly at the shoulder. By adding rolls of clay, joining them up as the work proceeds, the aperture is narrowed till it is ready for the last thick roll from which the short cylindrical neck is modelled.

In the undermentioned methods the coiling process plays an important part, and in some cases the whole of the vessel is built up by coiling.

The Cherokee Indians of North America made the base of a pot by modelling, and added rolls of clay in circles—if in adding a roll it was found that it was long enough to overlap itself, the superfluous piece was pinched off. The joints were smoothed with the nail and a piece of gourd-rind, and before firing the clay was dried, scraped, rubbed, and finally polished with a smooth stone.

In North America, "the ancient Pueblo potter rolled out long, slender fillets or ropes of clay, varying in width and thickness to suit the size and character of the vessel to be constructed. They were usually perhaps from one-fourth to one-half an inch in thickness. When they were properly trimmed and smoothed the potter began by taking the end of a single strip between his fingers and proceeded to coil it upon itself, gradually forming a disk . . . At first the fillets overlapped only a little, but as the disk grew large and was rounded upward to form the body

* Hutton, pp. 53-54. † Hodson, pp. 47-48.
‡ Macmichael, Sudan Notes and Records, Vol. V., 1922.

of the vessel, the imbrication became more pronounced . . . Strip after strip of clay was added, the ends being carefully joined, so that the continuity might not be broken until the vessel was completed . . . So thoroughly were the fillets pressed down and welded together that the vessels seldom fracture more readily along the lines of junction than in other directions."*

The Carib women of Guiana (South America) lay a flat circular piece of clay on a board, the rest of the material having been rolled into long cylindrical pieces as thick as a man's thumb. "One of these rolls is now laid round the edge of the foundation so as to stand up round it like the rim of a tray. This rim is now manipulated between the finger and thumb; it is amalgamated with the clay of the foundation; it is flattened and smoothed; and, with great nicety, exactly that curve is given to it which it will have to bear as a part of the body of the vessel. On top of this another roll is now applied; and this is manipulated in the same way. In this way the vessel is gradually built up piece by piece; and its walls, though moulded only by the fingers, acquire a perfectly true curve."† A piece of the rind of a gourd is used to smooth the lip of the vessel, the body is smoothed and polished with a water-worn pebble or an old stone axe-head, and the pot is dried in the sun. A pattern is afterwards drawn by means of pieces of the bark of certain trees, the juices of which produce such colours as red, brown, and black. The final process is the slow baking of the vessels over a fire.

Coiling may be regarded as the typical American method, South and well as North.

In the Admiralty Islands, in the Pacific, the base of a pot is modelled from a lump of clay, and the rest is built up by adding rolls of the material.

Some pottery from New Guinea (Laukanu, on Huon Gulf)‡ is made entirely from rolls of clay, without any preliminary modelling of the base; the form is at first conical, and the coils very obvious. During the finishing process the base is rounded off, and the coils pressed and smoothed out, at first with the hand, but finally with the aid of a flat piece of wood or a smooth bone. The pots are fired upside down in a wood fire, and whilst still hot the inside is washed with a sort of sago gruel, which produces a coating of varnish. The coiling method has been recorded from other parts of New Guinea.

In Africa, the Baganda§ potters used a true coiling process, which was begun inside the base of a broken pot. All traces of the joinings were carefully removed by means of the fingers, a pointed stick, and a curved piece of gourd-rind. Coiling is also frequently employed in the Belgian Congo.

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* Holmes, 3, pp. 273-275. † Im Thurn, p. 276.
‡ Neuhauss, Deutsch Neu-Guinea, Bd. I., p. 319. § Roscoe, I., p. 400.

Amongst the Andamanese, pottery is made both by men and women. The implements used are a short pointed stick, an *Arca* shell, and a board (this being often either a sounding-board or an eating tray). The vessel is built up by continuous coiling, and is smoothed by means of the shell. Simple patterns are drawn in the soft clay with the pointed stick. The pot is first dried in the sun, or before the fire if the weather is wet, and is afterwards baked by burning wood inside and around the vessel.*

It may be noted that it is very rarely that built-up pottery betrays by its appearance the process by which it was made. There are, however, instances in which the pot fractures more readily along the lines of junction of the rolls of clay, and examples of this have been recorded from New Guinea, North America (especially Florida), and also in the case of some of the Bronze Age pottery of Britain. In North America, again, some of the best pottery of the ancient Pueblo Indians has its decoration founded on the imbricated coils which have been intentionally left unobscured; the Choroti and Mataco Indians of the Gran Chaco (South America) also sometimes leave the coils in evidence by way of ornament.

## The Decoration of Hand-made Pottery.

[Octagonal Centre Case N.]

The surface and colour of a finished piece of pottery depend upon the fineness and the chemical nature of the clay, upon the mechanical treatment of the surface before (or occasionally after) it is fired, upon additions that may be made for decorative or other purposes, and upon the conditions under which it is fired; the ornamentation of hand-made pottery is almost invariably effected before firing, whilst the clay is soft, or is only slightly hardened by drying.

The ground colour of primitive pottery to which no slip or "wash" has been applied, may be red, buff, brown, or black, and irregularly fired ware may show a mixture of such shades. The inner layers, when exposed by fracture, may often be seen to be of a different colour from the surface, and the interior face of a pot may differ from the exterior. It is largely owing to the varying proportions of iron in different clays, and to the chemical effect on the iron of the varying conditions under which firing takes place, that this diversity of colouring occurs. If the clay is baked in a fire which is supplied with an abundance of air, the contained iron is left in the oxidised condition as red, or ferric, oxide, and this will colour the earthenware more or less conspicuously, according to the composition of the clay.

* Man, p. 374

If, on the other hand, the pots are baked in a fire which receives an inadequate supply of air, then the iron will be "reduced" to the black oxides (ferrous oxide—which is blue-black—and magnetic oxide) with a resultant darkening of the ware, intensified in many cases by a deposition of soot from the smoke. The usual primitive method of firing pottery is in a reducing fire of this kind, and there are often also irregularities in the supply of oxygen which lead to unevenness of colouring. A common colour of primitive pottery is a brown or nondescript tint, and it is a sign of advancing technique when the ware is uniformly coloured red or black.

Black pottery, which is of frequent occurrence from ancient down to modern times, may be produced in more than one way, and the colour may be superficial, or diffused throughout the substance of the ware. The black oxides of iron, and carbon added to the clay or deposited as soot during firing, are well-known causes of black pottery, and there are instances of the application of graphite as a surface coating (see p. 37). In the case of ancient pottery, where the methods have not been recorded, considerable controversy has been aroused as to the means employed.

(For specimens illustrating the methods of decorating pottery, see the octagonal centre case, and also the series showing methods of decorating wheel-made pottery, in centre case H).

### Decorative Processes.

1. Since the appearance of pottery may depend very largely upon the physical and chemical constitution of the clay employed, the first method of decoration may be regarded as that which determines the *colour and the texture of the surface* of the vessel. By procuring clay with its particles in a state of fine sub-division, or by removing the coarser materials from a crude clay, pottery may be obtained with a smooth and even surface, which will take a polish. Colour may be determined by choosing clays—if available—that will, under suitable conditions of firing (reducing or oxidizing), burn to a desired shade. Organic matter in the clay chosen may produce darkening of the ware, by its carbonisation, though this is not a usual cause of blackening (see below).

2. *Smoothing, polishing, or burnishing* the surface of the vessel, before firing, with the wet hand, or (sometimes after firing as well) with a burnisher of wood, bone, stone, etc.

A good example of plain polished ware may be seen in the gourd-shaped Malay bottle, from Perak; the polishing was done with a smooth implement of metal, after the clay had been dried for a short time. It must be emphasised that the polishing and burnishing of pottery can only be done after methods have been adopted of procuring clay in a state of fine sub-division,

for use as paste* or as slip. The coarse hand-made ware of Neolithic Britain would not admit of polishing, but some of the Bronze Age pots were no doubt subjected to this process. Long before this time, however, polished hand-made wares had been produced in the Eastern Mediterranean region (Egypt, Cyprus, Crete). Many modern backward peoples produce wares which are fine enough to take a polish, and where slip is (or was) in use, as in America, polishing or burnishing is a usual method of finishing off the surface.

3. *Adding powdered charcoal* to the clay, and firing in a reducing fire; in many cases soot from the smoke of the fire would also be deposited on the surface of the ware, since the primitive potter, with his open fire, is rarely able to bring about reduction without smoking the ware at the same time. The addition of charcoal to the clay is not of frequent occurrence, but it has been recorded in Africa and elsewhere, and it appears to have been practised in prehistoric times in Europe.

4. *Smoking the ware* during the firing process, or after the firing is completed; this may involve a more or less complete reduction of the iron to the state of the black oxides, and the colour will be due partly to these oxides, and partly to carbon from the smoke, the proportion varying according to the amount of iron in the clay, and the conditions of firing. It should again be noted that given a sufficient quantity of iron in the clay, a black colour may be produced by reducing only; in the present method however, the deposit of soot, which may penetrate more or less deeply into the clay, plays the determining part in the colouring of the ware. By polishing or burnishing a fine black surface may be obtained.

Much ancient European pottery was blackened in the above way, and the ancient Peruvian black-ware is largely of this class. The Baganda of East Africa obtain a highly polished black-ware by subjecting pots, after firing, to the dense smoke of a fire of leaves and grass;† after cooling, the black deposit is polished with a piece of bark-cloth (see specimen).

5. *Varnishing with resin or gum* after firing, whilst the vessel is still hot, or re-heating after the resin is applied.

This method is widely distributed amongst pottery-making peoples. In addition to the ornamental effect, it also renders the vessels less porous. The Fijians applied pine resin to some of their several kinds of vessels, rubbing it on whilst the pots were still hot from the fire. Some of the Pueblo Indians of America coated their black pottery, whilst hot, externally with the mucilaginous juice of green cactus, internally with piñon

* The "paste" is the clay, as found, or as prepared by washing, tempering, etc., which is used for the body of a pot without further treatment.

† Roscoe, I, p. 402.

juice or pitch, and a second or even a third firing was given, with resinous wood fuel; the pots were then waterproof, fireproof, and varnished hard, with a black gloss inside.* The Boloki of the Mobangi River (Central Africa) rub lumps of gum-copal on pots that are hot from firing; some of them are previously rubbed with arnotto dye, which produces red ornamental markings below the varnish.† The Kabyles of North Africa apply a resinous varnish to their slip-ware. In Borneo dammar gum is sometimes used for varnishing pottery.

It should be noted that vegetable varnishes are much inferior to mineral glazes (see p. 45), since they will not resist intense heat.

6. *Making impressions on the soft clay* with the fingers or the nails; with cords or textiles; with sticks or rods ending in a square, a triangle, etc.; with stamps bearing carved designs; the piercing or punching of holes through the clay wall may be mentioned here.

Decoration by impression, with the fingers or otherwise, is very widely distributed, and is perhaps as old as the potter's art itself. The casual imprints of the fingers or the nails would readily suggest further developments in this direction.

The Indians of the eastern and central areas of North America used their fingers for producing pinched and indented decoration. Frequent use was made of fabrics and cords for impressing designs, and in some parts paddle-like beaters, wound round with cord, were used to give a textile effect; stamps were carved with textile patterns to give a similar kind of ornament. Thin discs, or roulettes, grooved or indented, were mounted so that they could be rolled over the clay, marking as they went.

The Bronze Age pottery of Britain was extensively decorated with impressions made with such implements as blunt and sharp points, hollow reeds or quills, notched wheels, as well as with cords and twisted thongs; the fingers were also used. Similar, though less extensive and varied, impressed decoration is also found on the still earlier Neolithic pottery of this country, whilst some pottery of this period from Denmark (Slesvig) shows interesting transitions from early cord imprints to the imitation of these by other means; here, also, cockle-shells were used for making impressed designs. The Anglo-Saxon hand-made pottery is especially noteworthy for its stamped imprints.

Pottery from almost any part of the world could be selected to illustrate the method under discussion, which is well shown in the potsherds from New Guinea, exhibited in the case, where the designs are produced by the repetition of imprints of simple character. The specimen from Perak, in the Malay Peninsula, illustrates the use of carved stamps, which have also been noted

* Cushing, p. 495. † Weeks, p. 88.

in Africa, Borneo, as well as in America.) (Good examples of finger and thumb imprints may be seen on some Old English pottery in the exhibit illustrating the decoration of wheel-made pottery, in Case H.)

7. *Incising or scoring lines* with the finger-nail, a pointed stick or bone, a sharp stone, or some such simple tool; or grooves may be made with a quill or a hollow bone. This method is as widespread as the last-mentioned, though gouging is not so common as incising. In some cases marks are made by means of a blunt tool, drawn lightly over the surface of the wet clay, and this has been called "trailing." Examples of scoring and incising are shown in the case, in ancient as well as modern specimens.

A special kind of incised decoration may be mentioned here, though it can only be employed when slip-coatings are in use. In this case lines are incised or gouged through the slip to expose the colour of the underlying body of the ware; to this form of decoration the term *graffiato* is applied, and it is found on wheel-made slip-ware more frequently than on hand-made wares (but see large Nigerian bowl exhibited).

8. *Emphasising impressed or incised designs with white or coloured earths, etc., either before or after firing.*

This method is not so frequently employed as some of the others mentioned, but it has a wide distribution both in space and time. The Baganda rub ground shell or red clay into lines scored before firing; in Kumasi, lines are scored through the red ochre with which the pot is coated before firing, and the design is afterwards filled in with white. Similar practises date back to Neolithic and Bronze Age times in Europe, in Crete, the Swiss Lake Dwellings, and Denmark, for example. The Araucanian Indians ornament some of their pottery by a somewhat elaborate method of this kind. A design is first traced in the moist clay, and this is emphasised by gouging out the clay along the lines of the design; at this stage the pot is fired. After cooling, the design is filled in with a fine white clay mixed with powdered shell, the inside of the pot being lined with the same mixture. The pot is then fired again, and after cooling the surface is polished.

9. *Applying surface ornament*, in clay, in the form of knobs, bands, fillets, animal or human figures, etc.

Relief ornament may occur on pottery from practically all parts of the world. In its simplest forms it is represented by ridges and bosses, the latter sometimes serving to facilitate the suspension or carriage of the pot by means of a cord. The addition of animal or human figures in high relief or in the round, necessitates the separate shaping of the ornament, and this may be done by modelling with the fingers or with tools, or by shaping

or stamping in a mould. Slip is often applied so thickly as to produce designs in relatively high relief.

Applied ornament in relief is illustrated in the case by a New Guinea bowl with a network of ridges, and by an Ancient Peruvian pot with an animal figure attached.

10. *Cutting or modelling* the surface so as to leave a design standing up in low relief, sometimes in a depressed area which may be shaped as a panel.

The carving or modelling of relief ornament on the surface of the clay is well seen in some of the pottery of the ancient civilisations of America. Some New Guinea potters, also, obtain simple relief designs by scraping away the background.

The effect of relief has sometimes been produced by pushing out parts of the wall of a vessel from the inside, forming ridges or bosses (some Anglo-Saxon hand-made pottery); or by indenting parts of the wall from the outside (Ancient Peru).

11. *Applying pieces of foreign materials* to the surface of the ware. This is not a common method of decoration, but it was already known in Neolithic and Bronze Age Europe, when the potters of the Swiss Lakes attached pieces of bark to the surface of some of their pots; plates of tin were also applied, in the Bronze Age. Bronze plates and studs have been recorded.

12. *Covering the surface of the vessel, before firing, with white or coloured slip* or with a "wash" made chiefly from hæmatite or ochre. The surface is often polished before firing, and frequently serves as the ground for the reception of painted designs.

Although the bulk of the hand-made pottery of backward races is made from clay which contains a considerable proportion of iron compounds, many primitive potters have discovered clays which burn to a yellow, cream, or whitish colour, either owing to the presence of substances, such as lime, which affect the chemical reactions of the iron, or owing to the low percentage of iron in the clay. The finer and whiter clays being less abundant than common clay, it has been the usual practice to make use of the scarcer material as a covering to the ware, rather than as the constituent of the body of it. The fine clay is mixed with water to form a slip of a consistency suitable for the purpose; in some cases the dried clay vessel is dipped into the slip, or this may be applied with the hand or a brush, and after further drying the vessel is fired. The slip may be applied to portions only of the vessel, in the form of bands, panels, etc., and this restriction constitutes an approach to painting, for which slip has been widely used.

Other colours besides those mentioned above were obtained in some regions, and the ancient American potters, who used slip to an extent unknown elsewhere, possessed a considerable

variety of clays for their slips. White was the commonest amongst the ancient Pueblo Indians, as amongst their descendants to-day; the Chiriqui Indians of southern Central America used slips of greyish-white, pale orange, bright red, etc., and in ancient Mexico, white, cream, yellow, red, brown, and black slips were used. The ancient Peruvians and the Maya had similar colours.

It will be observed that these colours are mostly such as may be obtained from clays of varying iron-content, or from washes made from earths consisting mainly of compounds of iron, and especially of hæmatite and ochres. This use of iron ores is one of the earliest methods of obtaining a fine surface in black or red, since it dates from prehistoric times in Egypt; here the vessel appears to have been coated, before firing, with a hæmatite wash—which may well have been applied in a manner similar to that still adopted in Egypt (see p. 27)—and the baking of the pot was done in a fire which would leave the iron in the oxidised condition (red oxide). The whole, or the greater part, of the surface of these pots is, therefore, red in colour. The pots were, however, often fired with the mouth downwards, with the result that the ashes tended to cover up this part of the pot, and to place it under conditions of oxygen supply which reduced the iron to the black oxides. Hence we have the "black-topped" pottery, which is often black inside as well (see specimen shown). Prehistoric "red-faced" pottery has also been found in other parts of the Eastern Mediterranean (Cyprus, Malta, Sicily).

Pottery coated with white slip is apparently later than the red-faced ware, but it was made as early as the Bronze Age (Cyprus, Sicily.) The modern Kabyles of North Africa make both red and white slip-ware, with designs in black (iron oxides), and this ware appears to be a derivative of the prehistoric pottery of the ancient world. The red slip of the Kabyles is made from ordinary clay with the addition of hæmatite, and the white is chiefly kaolin.

Both in North and South America the use of slip-coating has persisted till modern times, but in Africa it is not so commonly employed; it has, however, played an important part in the decoration of much of the wheel-made pottery of the Old World.

An unusual kind of slip is that recently recorded amongst the Banyoro or Bakitara of East Africa.* Pottery that was intended for the use of the king was blackened by means of graphite ("black-lead"). This material, in a powdered form, was mixed with water and the glutinous juice of a shrub, and was then painted on the pot. After drying, the surface was polished with a smooth stone, and the pot was fired. Another polishing followed the firing, and the vessel thus received a fine silvery black lustre. In some cases the graphite was mixed with butter

* Roscoe, 2, p. 227.

and blood, and this was made into hard balls, with which the pot was rubbed till it showed a bright polish. It has been stated that a graphite slip was used by the Ancient Peruvians, and the black polish on other pottery has been attributed to graphite, in some cases erroneously. Bands and panels blackened with graphite may be found on some pottery of the early Iron Age in Europe, and on some modern African pottery (see specimen).

It may be noted here that the transition from the use of slips to that of tin-enamel took place in Europe during the sixteenth century, when the earlier mezza-majolica of Italy, which was a slip-ware, gave place to the fully developed majolica, which had a coating of tin-enamel, at first produced by adding oxides of lead and tin to the clay-slip (see p. 47).

13. *Painting designs* in white or coloured clays in the form of slip, or in paints usually consisting chiefly of natural compounds of metals such as iron and manganese, on the surface of the vessel before firing or, more rarely, after firing ; resins and vegetable dyes are also sometimes used.

Painted hand-made pottery extends in time from prehistoric Egypt till the present day, and it has much the same distribution as slip-coated ware. The best hand-made painted pottery of recent times is that of America, and in that region still finer work of this kind was produced before invasion by the white man. Much of the ancient pottery of the Eastern Mediterranean, both before but especially after the wheel came into use, was painted ware of artistic workmanship.

It is not within the scope of this book to discuss the immense range of the designs met with on painted pottery.

## The Museum Collection of Hand-made Pottery.

Reference has already been made to most of the specimens exhibited in the special series illustrating methods of decorating hand-made pottery. In the general collection specimens are exhibited from most of the regions where hand-made pottery has been produced in recent years, but with the exception of a few Ancient Egyptian (Tarkhan, Dynasty I.) examples, and several from Cyprus (Bronze Age), the pottery of prehistoric times is scarcely represented. The need of specimens of prehistoric date—Neolithic, Bronze Age, Early Iron Age—and of the Anglo-Saxon period, is particularly felt.

New Guinea and the Fiji Islands have provided most of the Museum specimens from the Pacific, though there are also one or two pots from the New Hebrides, where the art now appears to be extinct. There is a good selection of potsherds from the sites where these and other remains of an earlier population have been dug up at Collingwood Bay, near the eastern end of

New Guinea. A modern beater, for use in modelling the clay, in form a small wooden bat, from the same region, is exhibited.

America is most fully represented by the collection of ancient Peruvian vessels, showing a variety of human, animal, and plant forms. These mainly belong, however, to the late Truxillo class, the painted Nasca ware not being represented. Several ancient specimens from Ecuador are shown, and there are modern examples from one or two other regions, the best being some painted slip-ware from eastern Peru (Conebo Indians). The specimens from North America are restricted to ancient and modern Moqui and Pueblo Indian pots from Mexico, New Mexico, and Arizona, chiefly painted slip-ware.

Specimens from various parts of Africa are shown, their lack of variety in colour and the simplicity of their forms contrasting with the American pottery. The Batanga pots (from near Victoria Falls) illustrate the use of graphite to produce ornamental panels and bands. The stages in manufacture of a pot from rings of clay by a Bagua woman (near Lake Tanganyika) is illustrated by specimens secured in the unfinished state. Several specimens of Kabyle pottery, with painting on slip (red and white), are exhibited.

The only hand-made pottery from Asia available for exhibition, is that from Perak, in the Malay Peninsula, which consists of finely-shaped bowls and bottles (the shapes being based on the coconut and the gourd, respectively), with designs impressed, and ridges in relief.

Many of the methods of decoration described in the previous section may be identified on specimens in this case, though some of the more striking examples have been chosen for inclusion in the special series illustrating decoration (black octagonal case).

## Wheel-made Pottery.

[Centre Case II.]

### Earthenware, Stoneware, and Porcelain.

In its widest sense the term pottery may be taken to include earthenware, stoneware, and porcelain, and this is a convenient, though unscientific, classification of ceramic products.

All the hand-made pottery of backward races, and of prehistoric times, is *earthenware* in its primitive form of baked clay, porous and usually without true (mineral) glaze. Much of the modern wheel-made pottery from India is of this class, though glazing is practised in some parts. Most of the crockery in use in our own country at the present day is glazed earthenware, though porcelain is now cheap enough to be often used for ordinary domestic vessels.

Both stoneware and porcelain may be regarded as products of civilisation.

*Stoneware*, though apparently very different from earthenware, may be made from similar kinds of clay, but it is heated to a much higher temperature. As a result, the material undergoes a certain amount of fusion, and becomes impervious to fluids. It is, moreover, much harder and more durable than earthenware. Although no glaze is necessary, it has long been the practice to produce on the surface of the ware a thin transparent coat by vapourising common salt in the kiln where the stoneware is being fired (see p. 47). This "salt-glaze" was known to the potters of the Rhine region in the fourteenth or fifteenth century, and was thence introduced into this country.

The materials employed for the manufacture of the more typical stonewares are selected and combined with great care, and they include a much higher proportion of silica than either porcelain or earthenware. It may be useful to give the following figures for reference* on this point :—

| | Stoneware. | Roman "Samian" Earthenware. | Meissen Porcelain. |
|---|---|---|---|
| Silica .. .. | 80 per cent. | 61 per cent. | 58 per cent. |
| Alumina .. | 12 ,, | 21 ,, | 36 ,, |
| Potash and Soda | 5 ,, | 5 ,, | 5 ,, |
| Lime and Iron | 3 ,, | 13 ,, | 1 ,, |

In Chinese porcelain the silica may rise to over 70 per cent., whilst the alumina falls to about 20.

*Porcelain* is regarded as the highest achievement of the potter's art. It is distinguished from earthenware, and usually from stoneware, by its hardness, translucency, and whiteness of substance. But ". . . just as it is impossible to draw any fixed line of demarcation between earthenware and stoneware, it is equally impossible to find any sharp dividing line between the finer stonewares and true porcelain. The tests of hardness, of whiteness, and of translucency all in turn fail us. It is possible to produce stonewares as white, as hard, and as transparent as many of the forms of porcelain. Yet there remains an essential difference between them."† This difference, as far as the chemical ingredients are concerned, is mainly in the relative proportion of silica and alumina (see above).

True porcelain, such as that of China and Japan, and some of that of Europe, is made from materials derived from granitic rocks. The essential components are kaolin, or china clay (chiefly hydrous silicate of alumina, formed by the decomposition of felspar), and felspar (silicate of alumina and potash), together with quartz or silica. The distinctions between "hard paste" and "soft paste" porcelain cannot be considered here in detail, but it may be mentioned that the former is essentially composed of the above-named ingredients, which are associated

* Dillon, I, p. 7. † Burton, p. 13.

with each other in nature, whereas the latter is an artificial mixture of various substances which have no relation to each other under natural conditions. In most Old English porcelain the ash from burnt bones is an important constituent. Hard paste porcelain is harder and more vitreous than that made from soft paste. The old porcelain of Chelsea, Bow, Derby, Worcester, and most other places in England, was made from soft paste. On the continent hard paste porcelain was especially characteristic of Germany, whilst that of France was mainly soft paste.

The making of porcelain originated in China, where it was known in the tenth century A.D., and perhaps some centuries earlier. From the artistic point of view the highest development was reached in the eighteenth century, and at the beginning of the same century the European potters had their first considerable successes in the imitation of the ware that had long been imported from the east. The Japanese acquired the art of making porcelain from the Chinese towards the end of the sixteenth century.

### Throwing, Pressing, and Casting.

For the sake of completeness, a few words may be said here as to the chief methods of shaping pottery in countries where the wheel is in use, and where quantities of pottery are produced for trade. The methods have already been referred to in passing.

*Throwing.* Wheel-made pottery is "thrown on the wheel"; the origin of this appliance is discussed below. It may be noted that in some cases the lathe is used to complete or perfect the shape of the vessel, and also to produce ornamental markings.

*Pressing.* This is a moulding process, and the clay is shaped by pressing it in a mould consisting usually of plaster of Paris. A mould may be used for separate parts of a vessel.

*Casting.* In casting, the clay is made into slip, and this is poured into a mould of plaster of Paris; the material of the mould absorbs water, and clay is deposited as a thin layer on the surface. This method is well adapted for the production of delicate thin-walled vessels, and it was used for the finest salt-glaze pottery of the 18th century.

### Firing.

The invention of the kiln for firing pottery was later than that of the potter's wheel, but it was known to the Ancient Egyptians, Greeks, and Romans. Amongst other advantages, the kiln enables greater heat to be obtained, with better control of the access of air. The subject of the evolution of the kiln from the open wood fire, and the variety of types that have been used, is, however, beyond the scope of this Handbook.

## The Potter's Wheel.

The potter's wheel is an appliance by means of which the clay can be rapidly rotated during the making of the pot; by placing the clay in the centre of the wheel, which is horizontal, and shaping the soft material with the hands during the rotation, trueness of form is arrived at with greater ease and certainty than can be the case with pottery shaped entirely by hand. It is, of course, only in the making of vessels that are to be circular in section that the potter's wheel is of service, but since most useful vessels are of this form (often more or less modified by alterations or additions made after the general shaping is completed), the invention of the appliance was a most important step in the art of pottery-making.

It has already been noted that in many cases the clay foundation of a hand-made pot is supported on an object which gives facilities for slow rotation, so that the work may be carried on from all sides in turn. In the Malay Peninsula an interesting development of this arrangement has been recorded; the pottery from Perak (several examples of which are shown) is made by women, who support the clay on a piece of board, roughly circular, and about 8 in. in diameter.* In the Perak Museum there is one such wooden disc, which has a pivot passing into a hole in another disc, which rests upon the top of the first. The upper disc thus turns round very easily, and though it was used for slow rotation only, and not for the rapid spinning of a potter's wheel, it clearly approaches very nearly to this appliance.

The Asaba of the Niger (West Africa) model their pottery in a heavy shallow bowl of earthenware, which rests in a depression in a rectangular piece of wood; the bowl rotates easily, and it appears that the device acts in some degree like a potter's wheel, and not merely as a revolving support. A still more wheel-like contrivance is used by some tribes of the Lower Congo. In this case a thick rectangular board is fastened horizontally on the ground by means of pegs passing through the wood. In the centre of the board is a much longer peg, which passes some distance into the ground, and also projects a little above the level of the general surface of the board. The projecting portion forms a pivot which fits into a socket in a thick circular slab of wood, upon which the clay is shaped. Since this appliance is used in the same way as the potter's wheel, it must be regarded as representing a stage through which the more developed wheel may have passed.†

The potter's wheel, like the plough, is purely an old world

* Wray, p. 26.

† Musée du Congo. Notes analytiques sur les collections ethnographiques du Musée du Congo. Tome 2, Fasc. I.—La céramique. Bruxelles, 1907.

appliance. It was known to the Ancient Egyptians at least as early as 3000 B.C.; it was mentioned by Homer, and was in use in Greece, Rome, and other Mediterranean countries of the classical period; in this area it first appeared during the Bronze Age. It reached the British Isles in the Early Iron Age (*i.e.*, not earlier than about 700 B.C.). In its simplest form, that is, when the wheel itself is turned by the hands or feet, without any mechanical device, it is still used in many parts of Asia and in North Africa. "The Indian potter's wheel is of the simplest and rudest kind. It is a horizontal fly-wheel, two or three feet in diameter, loaded heavily with clay around the rim, and put in motion by the hand; and once set spinning, it revolves for five to seven minutes with a perfectly steady and true motion. The clay to be moulded is heaped on the centre of the wheel, and the potter squats down on the ground before it."* A similar type of wheel—the *tournette* of French writers—was employed in ancient Egypt, and is still in use in Japan and elsewhere. There were two chief improvements on this type, both of which were known in classical times. In the one case the wheel was raised from the ground on a support, so that the potter could sit down in a convenient posture for his work, though he still had to turn the wheel by hand; in the other instance, a support was raised from the centre of the wheel to form a table for the clay, the wheel itself being turned by the feet. The latter type was introduced into Egypt in the time of the Ptolemies, and is still employed there; from this form the modern potter's wheel is derived, though the wheel is turned by means of a treadle, or it may be driven by steam power. Various primitive types of wheel survive in out of the way corners of civilised countries.

It is interesting to note that whilst hand-made pottery is usually the work of women, the potter's wheel is an appliance mainly used by men.

## The Decoration of Wheel-made Pottery.

[Centre Case H.]

It is convenient to consider next the decoration of wheel-made pottery, ancient and modern. Although there is some hand-made pottery which is so well shaped that it might have been thrown on the wheel, yet the use of this appliance opens out new possibilities in the shaping of the clay, or renders them far easier of achievement. The variety of graceful forms produced by the ancient Greeks is, in part, a testimony to the value of the wheel. It must not be supposed, however, that the use of the wheel necessarily leads to the production of fine pottery. Many other factors come into play, and there is wheel-

* Birdwood, vol. 2, pp. 404-5.

made pottery which is far inferior in appearance to much of the hand-made ware to which reference has been made. Nor did the introduction of the wheel lead to an immediate revolution in the methods of decorating pottery. Only by slow degrees did the ancient potters and their successors develop the processes used in the recent and modern work of civilised countries. In our own country, in particular, it is only within the last two hundred and fifty years or so that there has been produced (since Roman times) pottery which could be regarded as markedly superior to hand-made wares.

Although there are processes used in the decoration of wheel-made pottery which were never discovered by the potters who had no wheel, the more primitive methods of decoration survived, to a greater or less extent, long after the wheel came into use, and indeed, it may be said that none of these methods is yet extinct. In the exhibit illustrating the decoration of wheel-made pottery, many of the examples showing the application of simple methods are derived from modern India and mediæval (and later) England, though other regions have been drawn upon when convenient. It happens, also, that some of the methods of decoration mentioned under hand-made pottery cannot at the moment be illustrated in that series, whereas specimens are available for their demonstration in the series at present under consideration. The two series are, therefore, both overlapping and complementary. It is not necessary to tabulate again the methods employed by the wheel-using potter in common with his less advanced predecessors. The selection or preparation of fine clay may be a preliminary to the polishing of the surface, and here the wheel confers a distinct advantage, since by its rapid rotation it enables the necessary friction to be applied with regularity. The choice of light-burning clays is frequent, and has its culmination in the white earthenwares and porcelains with which we are so familiar. In modern India, amongst the ancient Romans, and elsewhere, the regulation of combustion, so as to produce black or red pottery at will, is a method of decoration easily identifiable. Examples of red, black, and white pottery are exhibited.

*Incising* the clay, *excising*, *imprinting*, and *piercing* or *punching*, are methods of decoration that may be found on wheel-made pottery from various countries. In the case are fragments of early English pottery that show the marks of finger and thumb in *pinching* an opposed series of indentations, and also the use of the thumb for dragging crescentic ridges of clay one over the other to form a decorative border round the rim of a pot. A beaker of black-ware from modern India shows the gouging out of a series of vertical furrows set closely together over the whole surface of the vessel. Graffiato ware (see p. 35) is represented

by a German plate, dated 1786. The circular furrows or lines produced round the circumference of a vessel by pressure on the clay as it revolves with the wheel is illustrated. The piercing, carving or punching of the clay, so as to produce small holes or larger fenestrations, is shown by specimens, the most interesting of these being a small Chinese bowl of thick porcelain, pierced with numerous small holes, and afterwards covered, both within and without, with a layer of tenacious glaze which persists over the holes, but leaves them far more translucent than the rest of the wall of the bowl (" grains of rice ").

*Relief ornament* produced in more than one way is illustrated by specimens from China, Japan, and elsewhere. The ancient Romano-British bowl shows the application of slip made from the same clay as the rest of the vessel, laid on so as to form a design in fairly high relief. The Chinese teapot in terra-cotta ware, made to imitate a section of the stem of a Prunus tree, has twigs with leaves and flowers in high relief. The Japanese rectangular-sided vase has its four sides made up of slabs of clay that were each stamped out as a whole, with the same stamp, carved with an elaborate design. A very delicate little Chinese porcelain bowl has floral ornament in very low relief, which is incised with very fine lines to indicate the veins of the leaves, etc.

Examples of the modern use of *slip*, both as a coating and as a paint for designs, is illustrated by specimens. Slip-ware is still made in local potteries in our own country.

It is in the use of glazes, enamels, and a variety of paints, that the pottery of civilised countries of modern times is most sharply marked off from the wares of ancient times, and of the modern backward races. We may therefore turn to a brief consideration of these advanced aids to ceramic decoration.

## Glazes.

Although in hot climates the use of porous pottery for storing water or other fluid has one advantage—the liquid is kept cool through evaporation—yet for most purposes it is desirable that the surface of the pottery should be hard, smooth, and impermeable. Examples have already been mentioned of methods by which the primitive potter endeavours to give his vessels such characters, but it is the civilised craftsman who has achieved these ends to perfection, and that by more than one method.

When suitable clay is used, a very high temperature may be applied in firing the pottery, with the result that the substance is partially vitrified, as in the case of stoneware and porcelain (see p. 40); these do not require glazing, though they are usually subjected to this process. But long before such dense wares as these had been produced it had been found that it was possible

to cover the surface of earthenware objects with a glassy mineral substance which rendered the material impervious to liquid, and less liable to disfigurement by stains or injury ; such a glaze—essentially a thin coating of glass—also gave a finish superior to that attained by polishing, and provided a surface well adapted to receive, or to protect, painted decoration. By the addition of metallic salts to the glaze, also, this could be coloured with a great variety of tints, and, as will be seen, it could be made opaque by the use of certain metals. In " crackle-ware," of which a Chinese specimen is exhibited, there is a difference in the degree of contraction (during firing) of the ware and the glaze, respectively, with the result that the glaze exhibits a network of fine lines ; the effect is intentional.

Glazes are by no means all of the same composition, nor are they all produced in the same way. Only a summary account can be given, but more can be learnt from the specimens and labels in the case.

*Alkaline glazes* were probably the first to be discovered, and they were applied by the ancient Egyptians to figurines and other small objects. These were often coated with a glaze consisting of silicate of soda (soda-glass), with the addition of copper to produce a blue or green colour. Alkaline glazes are only suitable for application to pastes containing a very large proportion of silica, and they are not used for ordinary earthenware.

*Lead glazes* have been, and are, of much greater importance. They were known to the ancients (Egypt, Babylonia, etc.), and are still in common use. They may be produced by sprinkling powdered galena (sulphide of lead) on the surface of the ware before firing, as was done by English potters from Norman times onwards for several centuries ; in modern processes the glaze is carefully prepared in a finely-divided state (from flint, china-stone, soda, borax, and carbonate of lead, or more complex mixtures), and is applied as a powder suspended in water. In any case, however, the finished glaze, after firing, is a silicate of soda, aluminium, and lead, transparent and colourless, if no metallic salts are present as impurities, or have been added to give colour or opacity. The ware may be fired before the glaze is applied, and is then said to be in the " biscuit " condition ; in this state it may be decorated with painted designs, over which the glaze is applied before a second firing (see below).

*Felspathic glazes* do not contain lead, and are typically porcelain glazes, of Chinese origin. They require a much greater heat for fusion than do either alkaline or lead glazes ; they are alumino-alkaline silicates, forming a boundary to the body of the porcelain (which they closely resemble in composition) rather than a deposit on the surface, as is the case with the other two types just named. The essential constituents for their manu-

facture are quartz and felspar (sometimes kaolin), though lime and other ingredients are often added.

*Salt-glaze* differs entirely in its mode of origin from the other glazes, inasmuch as it is not applied to the surface of the ware as a solid or a liquid. Common salt (chloride of sodium) is thrown into the hot kiln whilst the ware is being fired, and is volatilised by the heat. Reactions take place on the surface of the pottery by which the sodium of the salt combines with constituents of the clay to form a glassy silicate of sodium and aluminium. Salt-glazing requires a high temperature, and is usually applied to stoneware required for special purposes. It was formerly much used in this country for domestic pottery, such as the Staffordshire "salt-glaze," and Lambeth stoneware.

*Smearing*, or semi-glazing, has some resemblance to salt-glazing inasmuch as it is effected by volatilising in the kiln with the pottery, a mixture of such materials as salt, potash, and lead oxide.

### Tin-Enamel.

Whereas glazes are transparent, though they may be deeply coloured, a pottery-enamel is opaque, and whether coloured or not it hides the character of the underlying body of the ware which it covers. In this feature it resembles a covering of slip, but it possesses also most of the advantages of a glaze—it is, indeed, an opaque glaze. The best-known and most widely used enamel is that which depends for its opacity upon the addition of oxide of tin to a lead glaze. The finely-divided particles of the oxide do not dissolve in the glaze on firing, but remain suspended throughout its substance, and produce not only opacity, but whiteness; there is thus provided a suitable surface for the reception of painted designs.

Tin-enamel was known in Ancient Mesopotamia, and the knowledge of it appears to have survived in the Near East until it was brought to Western Europe by the Moors who ruled so long in Spain. The Majolica ware of Italy, already mentioned, arose in all probability out of the Moorish pottery of the 15th century, and the enamel was at first a mixture of white slip and tin-enamel. From our point of view the most important of the several wares of this class is the Delft ware of Holland, which resembled in essentials the Majolica of Italy, though the method of decoration was very different. Delft ware, whether of English or of continental manufacture, consists of a buff body—sometimes with very little colour—with a rather thick coating of tin-enamel; on this the designs are painted, and over all is a thin lead glaze. Blue, derived from cobalt, is the most common colour for the decorative designs, though other tints are not infrequent. (Specimens of Majolica and Delft are exhibited.)

**Coloured Enamels, Glazes, and Paints.**

Since the essential character of tin-enamel is its opacity, combined with the qualities of a glaze, the name cannot be refused to other opaque glazes. Of a very interesting nature are the paints or washes which gave a special character to two types of ancient pottery—the black-painted pottery of the Greeks and the glossy red Samian ware of the Romans (see examples shown). The exact nature of these glazes has not been determined to the satisfaction of all archæologists, but since the question is a chemical one, the views of Franchet,* who has paid special attention to problems of this kind, and who has investigated them by scientific and chemical methods, must carry great weight. The Greek black, which was used both as a complete covering and as a paint, is believed by Franchet to be due to the addition of magnetite —the natural black magnetic oxide of iron, usually containing a little oxide of manganese—to a glaze formed from quartz and carbonate of soda. The "glaze" of the Roman Samian ware is no doubt due to the use of red ochre in the place of magnetite in the glaze; in this pottery, therefore, both the body of the ware and the enamel owe their colour to the presence of oxide of iron in the form of ferric oxide. The body of the Greek ware, on the other hand, whilst owing its red colour to the same substance, has its coating or its painted designs in an enamel coloured black with the magnetic oxide of iron. At a considerably earlier date a lustrous black paint was applied to pottery in Western Asia (Susa), and this appears to have been made of a ferruginous earth in an alkaline flux, like the Greek black enamel. Other ancient pottery (*e.g.*, Cretan) has painted decoration of similar character.

In addition to the modern tin-enamel, there are others which have been less frequently used. Thus, antimony gives a yellow colour, and chromium a green or a red. A coloured glaze, which should be transparent, may be opaque if an excess of colouring matter is used; the superfluous material fails to dissolve in the glaze, and remains suspended in the form of fine particles, which produce opacity, as in the case of true enamels; this is the case with most of the "enamel colours" used on some European porcelain, whereas those of the Chinese contained less colouring matter and were transparent or translucent.

Paints such as those made by the primitive potter from metallic earths, and slip-paints, were not discarded when the potter's wheel came into use, but have persisted even till the present day. In modern advanced technique, however, a much greater range of colours is available, and by their use in associa-

* Franchet, p. 105 ff.

tion with glazes and enamels the colours obtained (usually as metallic silicates) from the materials employed are more varied, more permanent, and more effective than are those of earlier origin. Iron, copper, manganese, and cobalt are the principal metals used in decoration, and of these the first three have been long in use. By modern methods iron may be made to yield not only yellow, orange, brown, and red, but a range of greens. Copper will give blue, green, and red, whilst cobalt gives various shades of blue, black, and purple. Manganese alone produces black or violet. Chromium, a modern addition to the palette, gives various shades of green, and, as already mentioned, antimony is used for a yellow enamel. Gold produces a fine red, and is also, like copper, employed in the production of true lustre ware (see below).

Lead gives no colour, but is an important flux, and is active in modifying the tints given by other metals.

The chief processes of decoration of glazed and enamelled pottery may be briefly summarised as follows :—

1. The application of glazes or enamels coloured with metallic oxides to the whole or to parts of the surface of the ware.

2. Painting designs in metallic oxides on the surface of enamel before firing. In the heat of the kiln there is combination of the metals with constituents of the enamel. This was the typical method for European faience (tin-enamelled wares) from the sixteenth to the eighteenth century.

3. Painting, or printing with transfers, on glazes or enamels that have been fired, with metallic oxides to which a flux has been added. Subsequent refiring, at a lower temperature, vitrifies the colouring matter, and causes it to adhere firmly to the underlying surface. This is called "over-glaze," or "on-glaze," decoration. The colours are often called "enamel colours" (see above).

4. Painting or printing designs with paints of metallic origin on the surface of the ware itself, whilst it is in the "biscuit" condition (*i.e.*, fired but not glazed). The paints must be made from colours that will stand the heat necessary to fuse the glaze, which is applied over the designs. This is "under-glaze" decoration, and a much-used colour is the blue from cobalt.

5. The application of a preparation of gold, silver, or copper compounds to the surface of the glaze after firing, and then firing again, at a lower temperature, in a reducing atmosphere. The result is a metallic sheen and a play of iridescent colours, often combined with colouration of the glaze. The term "metallic lustre" should be restricted to the effect produced by this method of decoration ; it may be seen in certain old Persian, Spanish, and Italian wares, and there has been a modern revival of the process in this country.

6. Applying to the surface of the ware (after glazing and firing) a solution of a platinum or a gold compound, mixed with oil or other organic medium. On re-firing, at a low heat, the metal is left as a continuous deposit, so that the vessel looks like one of silver or gold. Whilst the well-known gold "lustre" ware is produced by the application of a gold compound, the so-called "silver" lustre is due to the use of platinum, not silver. The film of metal deposited is so thin that quite common wares were treated by this process during the latter part of the 18th century and the first half of the 19th. (It should be noted that "gilding" involves entirely different methods of applying gold.) Specimens of "lustre ware" are exhibited—the term "plated ware" has been suggested as more accurately descriptive, in order to avoid confusion with the true lustre ware.

## The Museum Collection of Wheel-made Pottery.

[Centre Case H.]

In the special series illustrating the methods of decoration of wheel-made pottery, the specimens cover a considerable range of space and time, as well as of technique. Many of those shown have already been mentioned, but it may be added here that the following countries are represented :—Ancient Greece and Cyprus, Roman Britain ; Modern Mexico, Nubia, Ceylon, India, China, Japan, Caucasia, Italy, Holland, Germany ; the Old English specimens include a green-glazed jug, a marbled costrel, a bellarmine, melon-ware teapot, Cadogan teapot, basalt ware mug, and "plated" ware.

The general collection of wheel-made pottery is restricted in its scope, partly owing to limitations of space, partly to other considerations. The object has been to show some of the more interesting wares, both of ancient and modern times, for comparison with the hand-made wares of primitive peoples. There is little that is of service to the collector who desires to identify examples of Chinese and Old English porcelain.

The ancient pottery includes examples from Cyprus, of about 700 B.C. and later, some of it "red-faced ware," some with painted ornament. The ancient Greek pottery comprises various types of vessels, some with black-on-red designs, of about the 6th century B.C., and the later red-on-black, together with some examples with designs partly in slip. The Romano-British pottery (1st to 4th century B.C.) includes Samian, Upchurch, and Castor wares, cinerary urns, amphoræ, lamps, etc., many of the specimens found in London.

Whilst the Samian ware is Roman and Gaulish, that found in Britain being made chiefly in the Auvergne district of France, the Castor ware, made especially in Northamptonshire, shows

a mixture of British (Early Iron Age) and Roman characters. (For Old English pottery, see next section.)

The modern pottery includes plain, painted, and glazed pottery from India; Chinese stoneware jar of the Han dynasty (3rd century A.D.); Chinese blue and white porcelain of the Kang-hsi period (1661 to 1722 A.D.), examples of egg-shell porcelain, etc.; Japanese Satsuma and other wares, including a porcelain vase decorated with cloisonné enamel.

## The History of Pottery in Britain.

In this country the history of pottery begins with the hand-made earthenware of the Neolithic and Bronze Ages, which consists of vessels of simple forms, often ornamented with designs impressed or incised in the clay before firing. During the Early Iron Age (Late Keltic Period) pottery of a much better finish was made, partly as a result of the introduction of the potter's wheel. It was during this period that the country was invaded by the Romans, who brought in their own methods of pottery-making, and are known to have imported considerable quantities of finished vessels. The Roman methods, as well as the survivals of those of the Early Iron Age, appear to have been swept away during the invasion of the Anglo-Saxons and Danes. As already mentioned, the Anglo-Saxon pottery was often made without the wheel, and is noteworthy for its stamped ornament.

From Norman times onward, down to as late as the early part of the seventeenth century, the greater part of the pottery of this country was what has been called "peasant pottery." It was made from ordinary clay, similar to that used by modern backward races for their coarse earthenware vessels. It appears to have been mainly the work of local potters, who added sand or pounded potsherds to clay from the nearest source, and shaped the vessels on the wheel. Before firing, the surface of the vessel was in many cases dusted with powdered galena, often in such a way that only the upper part was glazed; the presence of a small amount of copper with the lead gave a greenish colour to the glaze. Slip was sometimes used for decoration.

During the sixteenth century stoneware jugs were largely imported from the continent, especially from Germany, and probably about the end of the century certain Dutch potters began the manufacture of stoneware in London. The well-known "greybeards" or "bellarmines" are examples of this ware, and the early English examples were merely copies of forms brought over from the Continent.

It was in the early part of the seventeenth century that the crude costrels and pitchers of the middle ages began to give way to the beer mugs, the posset-pots, and the tygs of the succeeding period. "The first changes, as we may expect, were simple

enough, in all conscience. The same strongly coloured local clays, with little or no admixture of foreign substances, continued to be used, but greater care was taken with the preparation even of this common clay, and the finish and workmanship of the pieces decidedly improved. Very soon, too, we find the potters beginning to use those natural clays that burn to a light yellow or white colour, and so afford a decided contrast to the red brick-earth. These light-burning clays seem to have been precious substances to the peasant potter of the seventeenth century ; hence they were generally used as decorative adjuncts only, and there are but few instances in which they have been employed to furnish the body of the piece."* These clays were applied as dots, lines, bands, lettering, etc., and sometimes as a thin wash on the surface. Throughout the latter half of the seventeenth century the light clays were widely used in this way as "slip," and thus the English potters developed a method of ornamentation that had been known to the Romans, the Egyptians, and other peoples so many hundreds of years before.

It was largely the desire to rival Chinese porcelain that led European, and especially English, potters to the production of earthenwares and stonewares which are of no less interest than the porcelain they also achieved. The stages in ceramic development can only be touched upon here.

As in the case of stoneware, the English were indebted to continental countries for an important step in the making of earthenware. In Italy, during the fifteenth and sixteenth centuries, pottery was made in which the red or buff colour of the clay was hidden by a coating of tin-enamel, which gives a white ground on which decoration may be painted (see p. 47). The process of tin-enamelling was introduced into other countries, and in Holland, especially at Delft, the Dutch potters succeeded in producing earthenware which approached in appearance the blue and white Chinese porcelain, though it differed greatly in its composition and in durability. Delft ware became very popular in this country, and during the seventeenth century kilns were established in London at various points along the Thames, for the making of Delft pottery. At a later date Lambeth in particular became the chief centre for this ware, though much was also made at Liverpool and Bristol.

About the beginning of the eighteenth century there was a great increase in the number and activity of the English potters, leading to the important achievements of the second half of the century. An especially characteristic type of pottery was the *cream-coloured earthenware*, which owed its final improvement to the use of kaolin, introduced in connection with the experiments in the making of porcelain. This earthenware was at first

* Burton, pp. 22-23.

made of ordinary light-burning clay and calcined flint; from the same materials, but fired to a much higher temperature, and glazed by the vaporisation of common salt, the beautiful stoneware known as Staffordshire "*salt-glaze*" was produced. In these two kinds of ware the English potters achieved a close approach to the whiteness of Chinese porcelain, and no longer needed to hide the red or buff colour of the ware by means of tin-enamel, or coloured glazes. The production of other fine stonewares (brown, grey, red, black, etc.) was characteristic of the English pottery-making of the period, though the cream-coloured earthenware soon became predominant over all its rivals, including the tin-enamelled, or Delft wares. "By the end of the eighteenth century the great proportion of the English pottery manufactured was divided between cream-coloured earthenware and English bone china, with a small proportion of stonewares, black basalt, and jasper ware thrown in, as a kind of protest."*

Josiah Wedgwood (1730—1795) played a most inportant part in the development of English pottery, his name and those of his descendants being now indissolubly associated not only with the Staffordshire "potteries," but with the history of the subject in general. He was very successful with a number of the characteristic wares of the period, and did much to bring cream-ware into general use. Special mention may be made of his white and coloured "jasper ware," which depended for its qualities on the use of barium sulphate in the paste, combined in many cases with the employment of metallic salts (such as oxides of cobalt, manganese, etc.) for the colouration of the ware—blue, sage-green, and lilac being characteristic tints. Wedgwood's black basalt ware was also famous, and in this the colour was due to the addition of oxides of iron and manganese to the clay. Both jasper and basalt ware are to be classed as stonewares.

Little can be said here concerning English porcelain. The method of making soft paste porcelain does not appear to have been known here until about 1745 (Bow and Chelsea), whereas in Germany hard paste or true porcelain was made as early as 1709. True porcelain was not produced in this country until about 1768, when a factory was started at Plymouth. Very little success was achieved, however, and the characteristic porcelain of this country is that made of soft paste, usually containing bone-ash ("bone-porcelain"). By the year 1780 the best work had been accomplished and decline had set in.

The Museum collection of Old English pottery is exhibited in the "Bygones" Room, and it contains specimens of most of the ordinary earthenwares and stonewares, together with a few examples of porcelain. There are many gaps, however, and good examples of slip-ware, agate-ware, tortoiseshell ware, and salt-glaze are especially needed.

* Burton, p. 9.

## GLASS VESSELS.

[Centre Case H.]

The making of glass is an art which is very restricted in its distribution. It is not practised by any of the uncivilised races of man, and appears to have had its origin in one of the ancient civilised states of the Eastern Mediterranean region. Glass was known to the early Egyptians and became common in Egypt after about 1500 B.C., though at this period, and for some centuries after, it was produced by a primitive process and was only used for small objects. The history of the discovery or the invention of glass is unknown, and the conjecture that it was first formed by the accidental fusion of the necessary ingredients can only be put forward in the absence of evidence.

Little practical use was made of glass until it was discovered that the material, when softened by heat, could be blown out to form a vessel or hollow bulb. "It is after all in the development of the art of blowing glass that the principal merit of the glass-workers, in the age immediately preceding our era, is to be found. By this method the real capabilities of the material, both practical and artistic, were first disclosed. The art was probably first practised on the Phœnician coast, perhaps at Sidon, not long after the time of Alexander."* The ancient glass shown in the case belongs to this early period of blown glass, and dates from about the beginning of the Christian era. Many of the specimens illustrate the iridescent effects produced by decay, which is mainly the result of the action of the moisture and carbonic acid of the air or soil. Glass is made from silica (such as pure sand) and soda, together with small quantities of lime, and, on the surface of the glass, the carbonic acid decomposes the alkaline silicates, leaving behind an opaque scaly crust, consisting of an acid silicate of lime (or of aluminum or lead, when these elements are present in the glass). The colours that are seen result from the breaking up of the rays of white light into their constituent colours, which are those of the rainbow, as the light passes through or is reflected from the scales.

Glass was much used by the Romans for decorative as well as domestic purposes, and it was manufactured in most of the regions which formed part of the Roman Empire. Some fine examples of Roman glass have been found in this country, and glass vessels of small size are abundant. The Anglo-Saxons in Britain used various forms of glass drinking-vessels.

In Western Europe comparatively little glass appears to have been made for several centuries after the decline of the Roman power, though the art was still carried on in the manufacture of common glass vessels for domestic use, especially in parts of Central Europe. The making of stained glass for church

* Dillon, 2, p. 59.

windows was, however, of more importance. During the middle ages Egypt and Western Asia became the important centres for the production of glass, and it was not until the thirteenth century that the glass-workers of Venice came into the field.

During the sixteenth century Venetian glass reached a high level of excellence, and the methods by which it was produced began to spread over Western Europe. A noteworthy achievement of the Venetians was the invention of a perfectly colourless and transparent glass. In the seventeenth century German glass became the most important in Europe, and held the first position until towards the end of the eighteenth century, when its place was taken by the " flint " glass of our own country. The name " flint " glass originally signified that the silica was used in the form of flint instead of sand, but early in the eighteenth century the English glass-workers made a still more important change in the composition of glass for hollow ware, by substituting lead for lime and potash for soda ; the name flint-glass was transferred to this lead-potash glass, which still of course contained a large proportion of silica. A characteristic feature of lead-potash or " flint " glass is its high dispersive power, which enables it to separate the various-coloured rays that make up white light, more effectively than any other kind of glass. This property is more especially conspicuous when the glass is cut or faceted, the brilliancy and colour of the many facets giving rise to very beautiful effects.

Modern glass is turned out in great quantities by mechanical methods, and the use of moulds, in particular, renders it easy to produce passable imitations of cut glass, though the tendency of these processes is to suppress artistic development.

In addition to the early examples of glass-ware shown in this case, there are specimens of Old English wine bottles (seventeenth to nineteenth century) in the collection of "Bygones."

## THONGS, ROPE, AND STRING.

[Wall-case 30.]

"Every region of the earth has its own string. The Arctic peoples prepare thread and twine of sinew, some of them as fine as our best cotton, only very much stronger. The Japanese make excellent string of the mulberry paper; and the Chinese, as well as many peoples south of them, use bamboo splints, while the silkworm goddess is the patroness of the Far East. All over the Pacific Islands the coir, or prepared fibre from the outer husk of the coconut, is the staple from which string is made, not [only] by twisting, but chiefly by braiding. . . . In Mexico and South America the pita fibre and cotton furnish the principal staples, but all over temperate North America the *Apocynum cannabinum*, or Indian hemp, was made into yarn and twine, and woven into cloth. The hair of ruminants and of the dog easily lent itself to the spindle, and among some tribes skins with the fur on were cut into very thin strips, and these were twisted and woven into blankets. Bast from trees is frequently twisted into a kind of single ply twine, and used even for bow-strings.

"Sinew dressing is a textile art. The long and tough bundles of sinew are removed from the legs of the larger mammals, very carefully cleaned of any flesh or fat and dried. At convenient seasons these bundles are shredded just as men and women pick oakum. This shredded sinew is used without further preparation for seizing or wrapping thousands of things together."*

This quotation may serve to suggest the variety of materials used in preparing various forms of string or its substitutes. When strips of hide are employed, as often amongst the Eskimo and many African tribes, there need be no twisting of the strips, and the same may be the case when fibres of sinew or of plants are used in short lengths; strips of rattan are often similarly employed without any twisting, and these may be regarded as representing the precursors of string or cord. Before passing on to the consideration of true string, further reference may be made to the Polynesian sinnet, made by braiding the fibres of the husk of the coconut. This braid is very widely used in the Pacific, and it is often of extremely fine workmanship. For tying together the parts of implements, for fastening the parts of houses and of boats together, and for many other purposes for which we should use nails, it is in general use. It is held in the highest esteem, and in some parts was especially associated with ancestral deities. String is also made from the same material.

The most simple process by which fibres can be twisted together is that of rolling them between the thumb and fingers, or between

* Mason, 2, pp. 240-41.

the palms of the hand. In most cases, however, where the spindle is not employed, the fibres are twisted by rolling them along the thigh. The manufacture of true string involves the combining of two or more of the strands of yarn previously formed, so that a kind of double spinning process is performed.

The making of string amongst the aborigines of Queensland is thus described :—

"The *kalo* flax is worked up as follows :—The plant is collected into thick bundles, up to 4 and 5 feet long, and each tied round with string, the whole being then immersed in water for several days, with rock or stones on top to prevent its being washed away. Its fine outer skin is next stripped off the stems, one at a time, and beaten up and teased out until such time as it becomes quite soft, when it is sun-dried and rolled into skeins or bundles about a couple of feet in length. As the individual, who is sitting in the squatting position, wants to work it up, he pulls out of the skein a piece or two, some 3 or 4 inches long, and moistening it either with his mouth, or dipping it into some water provided in a koolamon [wooden trough] at his side, places it crossways on his thigh ; another and another thin and small length is picked off, treated similarly, and placed side by side upon the thigh, along which all three or four are rolled backwards and forwards with the open hand, until by twisting and rolling these few thin sets of shreds become a single composite one. When the next piece of composite thread is in similar manner made up from its three or four single components, it is placed end on end (not sideways, of course) with the first made composite one, and by a little rolling manipulation of the fingers, intertwined with it : a piece of about 7 or 8 inches is now obtained. By a repetition of this process the length of the newly-manufactured twine is gradually increased, while what is already made and completed, is rolled up into a ball. When two such balls have been made, the moistened strings from each, *while twisted in opposite directions*, are in similar manner rolled into one, in these relative positions, the double plait so formed being wound up as manufactured into a third ball, and in this last condition it is ready for use. It may be stated here that any increase in the thickness of the twine, when required, can be effected to any extent by this method of doubling, with the simultaneous rolling or twisting of each of the two strings in opposite directions."*

This process of twisting on the thigh is widely used, occurring amongst almost all backward races. The yarn which is the product of the first twisting is sometimes wound on a stick, and it is probable that in this way the spindle was invented.

* Roth, W. E., 1, p. 103.

The methods by which string and rope are manufactured in civilised countries cannot be discussed here, and the development of spinning appliances will be considered chiefly with regard to the production of yarn for weaving. It may be said, however, that the appliances used in the old rope-walks and in modern rope-making machinery are closely related to those used for the production of yarn.

Case 30 contains examples of thongs, rope, and string from most parts of the world.

# SPINNING.

## The Spindle.

[Wall-cases, 31-32.]

In parts of Australia string is made from human, opossum, or kangaroo hair, and a simple spindle is employed. It may consist merely of a stick about 8 inches long with a hook at one end. A short length of the hair is twisted and attached to the hook, and further twisting is done by rolling the spindle on the thigh. The yarn so produced is wound on the spindle, the hook serving the purpose of providing a point of attachment for the yarn, so that it may not become unwound, and also of affording a fixed point, which ensures that the yarn may be twisted by the revolutions of the spindle ; to this end it is necessary that after each winding of the finished yarn on the spindle, the part of the yarn which is nearest the unspun fibres shall be passed within the hook.

All the essential parts of a spindle are represented in this appliance of the Australian aborigines. As will be seen from an inspection of other specimens exhibited, the function of the hook may be performed by a notch or a groove in the wood, or by a spiral tip. It is not unusual for the twisting to be done by rolling the spindle on the thigh, and the end of the spindle may rest on the ground, or in a bowl ; or the spindle may be held so as to hang freely in the air, supported by the yarn and fibre. The spin is given by twisting with the hand, and in order that the motion imparted may continue as long as possible the spindle is weighted. In many cases this is done simply by making the spindle thicker towards the middle than at the ends —it is, in fact, "spindle-shaped" ; in other cases, the spindle passes through a perforated disc, or whorl, of wood, bone, stone, clay, metal, etc. Even where there is no whorl, the spun yarn that is wound on the spindle after a time becomes heavy enough to increase the length of spin to a perceptible extent. It may have been the observation of this fact that led to the invention of the spindle-whorl, which is probably an earlier device than the thickening of the spindle itself. Even in the spindles of some Australian tribes the spindle-whorl is represented, in the form of two crossed sticks through which the spindle passes.

Although by no means universal, the spindle is very widely distributed, occurring in all five continents. It is still in use in some parts of Europe, where it was known as early as the Later Stone Age.

The process of spinning in Dahomey (West Africa) was thus described by Skertchly :—

"Cotton is not cultivated at all, the supply being obtained from the wild growth. It is gathered and picked, and spread

out on nets to dry in the sun. When wanted it is placed in little heaps, and a small bow is used to separate the fibres and give it a 'fluffy' character. It is then fastened to a stick about a foot long, and is ready for spinning. The instrument for this purpose is a thin slip of bamboo, about a foot long, stuck through a heavy round piece of clay which acts as a fly [spindle-whorl], and the whole is then twisted by the fingers, the weight of the fly generating sufficient momentum to keep it in motion for a considerable time. The end of the thread twisted from the bundle of cotton on the distaff is attached to this, and as it twirls round the cotton is disengaged with the right hand, and when a thread of sufficient length to allow the spinner to touch the ground has been spun off, it is wound round the spindle-stick, hitched over its top, and the operation continued. A small quantity of wood ashes is placed near the operator, who from time to time takes a little on her fingers to prevent them adhering to the cotton fibres. The thread is very uneven, and as thick as crochet cotton. When a sufficient length has been spun it is woven into cloth."*

The following extract illustrates the varied nature of woman's work in South-west Africa :—

"The markets or sleeping-places are well supplied with provisions by great numbers of women, every one of whom is seen spinning cotton with a spindle and distaff, exactly like those which were in use amongst the ancient Egyptians. A woman is scarcely ever seen going to the fields, though with a pot on her head, a child on her back, and the hoe over her shoulder, but she is employed in this way."†

The distaff is a stick or rod, which is sometimes ornamented with carving or painting, often used to hold the bunch of fibres that is being spun. It is by no means an essential factor in spinning, as is sometimes suggested in careless accounts of the process.

Spindles from various parts of America, Africa, Asia and Europe are exhibited.

The spindle is in use over a great part of South America,‡ though twisting by hand—on the right thigh with the right hand, the left hand feeding—has an even wider distribution. The cotton-plant is all-important, and is cultivated by many tribes of Indians ; wool is also in use, and the spindle is usually employed for twisting these two materials. The Bororo type of spindle has a whorl, but no nick or hook at the end. When in use, the spindle is rotated horizontally on the thigh or calf ; the end to which the fibres are attached is usually supported between two toes of the left foot, as in a bearing. The Bakairi type of spindle is usually thickened at the end where the whorl is placed, and has a hook

* Skertchly, p. 494. † Livingstone, p. 399.

‡ *See* Frödin and Nordenskiöld, Ueber Zwirnen und Spinnen bei den Indianern Südamericas. Göteborg, 1918. (Man, 1919, 8.)

or nick at the other. In use, the twisting may be started by rotating the spindle on the thigh, but it is then immediately brought to a vertical position ; or the twist may be given in the air, or on a plate or shell resting on the ground ; some tribes spin whilst walking, after the old pastoral fashion.

Some South American tribes, who make use of the Bororo type of spindle and horizontal rotation, substitute for the thigh a billet of wood, or a stool. This arrangement may be associated with the use of the toes as above, or this natural bearing may be replaced by a wooden fork or rest. There is here a suggestion as to the way in which the rotation of the spindle on the thigh may have passed by gradual stages to its insertion in artificial bearings ; this was perhaps the fundamental process in the evolution of the spinning-wheel, which took place in Europe or Asia.

## Spinning-wheels.

[Wall-cases 31-32.]

The spinning-wheel is much more limited in distribution than the spindle, and it is not used by the more backward races of man. In the simplest types of spinning-wheels, the spindle is mounted horizontally in bearings, and is turned by means of a wheel, with which it is connected by an endless cord. There is usually a separate bobbin fixed on the spindle to receive the spun yarn. The process of spinning is intermittent, since the winding-on of the yarn is performed at intervals, after each length or "stretch" has been spun. The *charka* or spinning-wheel of the East is of this simple type, as is also the "muckle," or large, wheel which was used in Europe as early as the fifteenth century, and was recently still employed in remote districts such as the West of Ireland. It is possible that this form of wheel was introduced from India.

The small or "Saxon" wheel was invented in Europe in the sixteenth century for the spinning of flax, and in this the driving-wheel is worked by means of a treadle. The spindle, as will be seen from the specimens, is supported at both ends, and bears a bobbin for the yarn, as well as a "flyer," which plays an important part in the process of spinning. The bobbin and flyer are connected by separate cords with the driving-wheel, in such a way that the former revolves at a slower rate than the latter. The twisting of the fibre is performed by the turning of the flyer, and whilst this is going on the bobbin winds on the spun yarn that has been produced. The process of spinning is therefore continuous, and not intermittent, whilst owing to the treadle action the spinner has both hands free to manipulate the fibre. The later types of wheels were sometimes provided with two spindles, thus giving work for both hands (see example shown, from Scotland).

Both the intermittent and the Saxon wheels remained in use for many years after spinning machines were invented, the former being chiefly used for wool and cotton, and the latter for flax. The Saxon wheel is still employed in several parts of Europe.

The modern methods of spinning, which had their origin about the middle of the eighteenth century, are far too complex for description here. The first machine by means of which a number of threads could be spun at one time was Hargreaves' spinning-jenny, invented about 1764. This was of the intermittent type, but the later spinning-machine of Arkwright was continuous in its action. Crompton's "mule" (so-called because it combined features of the Hargreaves and the Arkwright machines) was invented about 1779.

In the case will be seen examples of the spindles used in the modern processes of "mule-spinning" and "ring-spinning," together with specimens of cotton yarn. In mule-spinning the process is intermittent, like that in the simpler type of wheel described above; the spindle itself resembles in form the wooden spindles with whorls, already described, but the whorl is represented by a wharve or pulley, round which passes the cord which brings about the rotation of the spindle. The process of ring-spinning is continuous, the yarn being spun and wound upon the spindle without any pause being required for winding on; in this respect the machine resembles the Saxon wheel. The spindles, both in mule-spinning and ring-spinning, are fitted to frames, and their revolution is produced by power (steam or electric) conveyed from a central source, which drives thousands of spindles at once, and also works the many other machines that are employed in a modern spinning-mill.

For a description of the processes through which a material, such as raw cotton, must go before it is ready for spinning, reference must be made to text-books on the subject. "Ginning" is an operation for the separation of the seed from the cotton fibres. "Carding" is the process by which the irregularly disposed fibres are brought into an approximately parallel arrangement, and the implements employed for this purpose range from the extreme simplicity of the Montenegrin wool-carders, shown in the case, to the great complexity of the modern carding machines.

# FROM SKIN-DRESSING TO WEAVING.

The subject of clothing in general does not fall within the scope of this handbook, but an important branch of the study of the domestic arts is that relating to the preparation or manufacture of dressed skins, bark-cloth, and textile fabrics. It can scarcely be doubted that skins were used for clothing and other purposes at a very early period in man's history, and the art of skin-dressing may therefore receive first consideration.

## Skin-dressing.

[Case 39.]

There is evidence that the skins of animals were extensively used by the inhabitants of Europe in the Old Stone Age, and the same is true of their successors of the Later Stone Age. This evidence is not, of course, in the form of skin-garments themselves, since these have long since decayed, but it is in the almost equally convincing form of flint implements adapted for the purpose of scraping away the fat and the superfluous flesh from the inner side of skins, as is done at the present day with closely similar implements by the Eskimo of the Arctic regions. The use of skins for clothing, for tents, and for other purposes, is very characteristic of northern peoples, such as the Eskimo, but native races in the warmer climates also make use of them, as in many parts of Africa for example. In civilised communities, skin and leather serve a multitude of purposes.

The following list of animals whose skins are (or were) used by various American Indian tribes is of interest:

"On the American continent alone women skin-dressers knew how to cure and manufacture hides of cats, wolves, foxes, all the numerous skunk family, bears, coons, seals, walrus, buffalo, musk-ox, goat, sheep, antelope, moose, deer, elk, all kinds of whales, squirrels of thirty species, beaver, gopher, muskrat, porcupine, hares, opossum, crocodile, tortoise, birds innumerable, and fishes and reptiles."* It will be noted that here again we are dealing with woman's work. The methods of preparing various skins calls for tools to bring them to the proper thinness when too thick, for rendering them supple, and for means of preventing their decay. In the process of preparation of a buffalo robe by the North American Indians, the hair was first removed by soaking the skin in water containing wood-ashes, or a natural alkali. The skin was spread flesh-side upwards on the ground and stretched out by means of pegs. The stretched skin became dry and hard by the action of the sun, and the

* Mason, 1, p. 71.

women "went to work upon it with a small instrument shaped like a carpenter's adze, having a handle of elk-horn or wood to which the blade was tied with raw hide. With this she chipped at the hard skin, cutting off a thin shaving at each blow, so as to remove the superfluous inner skin and leave a perfectly smooth inner surface. To render the skin soft and pliable, every little while the woman smeared the surface with fat and brains of buffalo, thoroughly rubbed in with a smooth stone."*

The tools of the Eskimo are different from those of the Indians. "The Eskimo women scrape off the fat with a special tool (like an oval cup with flattened sides) made of walrus ivory or horn and plane down the dermis with a stone scraper. . . . . Besides these, both Eskimo and Indians had hands and feet and teeth for pulling and pounding and breaking the grain."† The process of preparing birds' skins is more simple. "The Eskimo women made a most comfortable inner blouse or *parka* from the skins of birds sewed together, the feathers being worn next the person. We are told by those who have seen the operation that the only tanning or tawing through which the bird skins passed was a thorough chewing on the wrong side by the women and girls."‡

Many African tribes are experts in dressing skins, and the process as carried on in South Africa is thus described :—

"The Makololo use all the skins of their oxen for making either mantles or shields. For the former, the hide is stretched out by means of pegs, and dried. Ten or a dozen men then collect round it with small adzes, which, when sharpened with an iron bodkin, are capable of shaving off the substance of the skin on the fleshy side until it is quite thin ; when sufficiently thin, a quantity of brain is smeared over it, and some thick milk. Then an instrument made of a number of iron spikes tied round a piece of wood, so that the points only project beyond it, is applied to it in a carding fashion, until the fibres of the bulk of it are quite loose. Milk or butter is applied to it again, and it forms a garment nearly as soft as cloth."§ Specimens of the dressed skin and of implements are shown.

Over a wide area in Africa the process of skin-dressing has advanced as far as the production of the finest leather, such as is made, for example, by the Tuareg, Mandingo, and Hausa of West Africa. The real Morocco leather, also, is a North African product. The subject of the manufacture of leather is, however, beyond the scope of this handbook.

The specimens of skins and skin-dressing appliances exhibited in this series are chiefly from North America (Indian and Eskimo), and various parts of Africa.

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* Mason, I, p. 83. † Mason, I, pp. 73-74. ‡ Mason, I, p. 72.
§ Livingstone, p. 193.

## Bark-cloth Making.

[Wall-cases 40-41.]

Bark-cloth is a kind of natural textile which is prepared from the inner bark of many kinds of trees. It is adapted for use as clothing in dry climates, and may be used for a variety of other purposes. The preparation of this material is carried on in Africa, the Malay Peninsula and Borneo, parts of America, and in Oceania, where it is a very characteristic product. The general method of manufacture differs but little in all these regions—the bark is stripped from the tree (the outer rind, or true bark, being scraped away), and after being soaked in water is hammered with straight wooden beaters upon a log or table. The beaters used are square, round, or oval in section, and they are usually scored with longitudinal (sometimes also transverse) grooves. They are in most cases made of wood, but stone is sometimes employed in New Guinea, and ivory in Central Africa. Some African beaters are hammer-like in form. The object of the beating is to spread out the bark and reduce its thickness, and at the same time to consolidate the texture and give the cloth greater firmness. The Polynesian bark-cloth is made in several grades, and from more than one kind of tree, as may be seen from the following description, relating to the Society Islands :—

"The material of which it is made is the internal bark or liber of three sorts of trees, the Chinese paper mulberry (*Morus papyrifera*), the bread-fruit tree (*Artocarpus incisa*), and a tree much resembling the wild fig-tree of the West Indies (*Ficus prolixa*). Of the first, which they name *aouta*, they make the finest and whitest cloth, which is worn chiefly by the principal people. . . . . Of the second, which they call *ooroo*, is made a cloth inferior to the former in whiteness and softness, worn chiefly by people of inferior degree. Of the third, which is by far the rarest, is made a coarse, harsh cloth of the colour of the deepest brown paper: it is the only one they have that at all resists water, and is much valued ; most of it is perfumed and used by the very great people as a morning dress."* Young trees only were used, and they were pulled up before the bark was removed. The bark was slit down longitudinally and stripped from the trunk, and it was then soaked for several days in running water. The outer green bark was scraped away with shells and the remaining fibrous inner bark left overnight upon plantain leaves to dry. It was then beaten upon a long wooden board by women servants, using bark-beaters like those shown in the case ; these have grooves on each face, of different degrees of fineness, and the beating was done first with the coarsest face, and finished with the finest. Red, yellow, brown, and black vegetable dyes were often employed to decorate the cloth, which was

* Banks, pp. 145-146.

used both for clothing and for bedding. The designs were sometimes painted by hand, sometimes printed by means of raised stamps. The word "tappa" or "kappa," so often employed, is the Polynesian term for bark-cloth.

The Semang of the Malay Peninsula use the bark of the bread-fruit tree, and sometimes also that of the upas tree. The latter is cut down first and the bark loosened by hammering with a wooden cudgel, and it is then stripped off like a stocking. The bark is washed to free it from poison, dried for short time, and is ready for use.

In British Central Africa the hard outer bark is removed (from the fig-tree), and a large sheet of the inner bark is taken off by first cutting a long vertical line and then two circles. It is scraped, and then beaten with a mallet of hard wood, deeply scored with lines crossing one another. After folding, the double piece is hammered out, and again folded and beaten. Good bark cloth is very soft and pliable, and very warm in cold weather. Large quantities of bark-cloth are made in Uganda, and several different kinds of trees furnish the material. The use of bark-cloth for clothing is still common amongst many tribes in various parts of Africa, though it is being displaced by trade calico, etc.

Specimens from the Pacific, America, Africa, and S.E. Asia, are exhibited, and they include beaters, and stamps for imprinting designs, as well as plain and decorated examples of bark-cloth.

### String-work, Netting, etc.

[Table Case.]

To enter into a detailed account of the methods by which string-bags, fishing-nets, and similar objects are produced would involve the figuring of the various kinds of knots employed. The subject is illustrated by a few specimens in the case (chiefly from the Pacific and America) and more may be learnt from these than from long descriptions without figures. It may be noted that the needles or shuttles employed in net-making are essentially similar in shape from whatever part of the world they may come, and that they also resemble shuttles used for various purposes by civilised peoples.

### Sewing, Embroidery, etc.

The sewing together of skins was probably practised in the Cave Period of the Old Stone Age, as is suggested by the bone needles that have been found. A simple method is still practised by some modern peoples, who make perforations in the edges of two pieces of skin that are to be sewn together, and pass the sewing strand or thread through the holes, either with or without the aid of a needle. Some African tribes, and also the Eskimo, are especially skilled in this kind of work, the seams being often

scarcely noticeable. Awls and needles are used for many purposes, and the implements themselves are made in various forms and of various materials, as may be seen from the specimens exhibited.

The decoration of skins, textiles, and other materials by means of embroidery, or by the attachment of beads, porcupine quills, etc., cannot be discussed. Some examples will be found in the section of Decorative Art (in Case 45a). It may be noted here that embroidery, which consists in sewing ornamental threads on or through a material already prepared, differs essentially from the decoration of a fabric, such as cloth or tapestry, by means of coloured designs formed by threads which are part of the fabric itself, and are woven in during the process of manufacture.

## Mat-making.

[Wall-cases 33-34.]

Mats of various kinds are made by many races, civilised and uncivilised. The art is allied on the one hand to that of weaving, and on the other to that of basket-making. It is not necessary to enter into a detailed description of methods or results, but a few points may be briefly noted. As in the case of woven baskets, the two sets of elements employed may be interwoven to produce chequer-work, twilled-work, and twined-work, whilst many mats resemble wickerwork in the fact that one set of elements (the warp) is more rigid than the other (weft). As with basketry again, variety and ornament are introduced by using elements differing from each other in colour, thickness, and rigidity. The warp may be set up in a frame, as it is in true weaving, but the warp strands are moved singly for the passage of the weft, as in the case of basket-weaving. For example, "the Chilkat Indians of Alaska weave a ceremonial blanket of cedar bark, and wool from the mountain goat . . . [see example in Decorative Art section, Case 46], but there is no shuttle [and no heald] employed. The warp threads are set up in a frame, and the weft is wrought in by twined-work, after the manner of a tapestry worker. It is, in fact, the T'lingit twined basketry in pliant material. All over the North American continent cloth and matting were thus produced."*

The painted Haida blanket exhibited is in twined weaving, and it will be noted that there is a considerable interval between the lines made by the weft in crossing the warp. The Maori of New Zealand make flax-mats of a very similar nature, in the same technique, and several specimens are shown. The term "tied cloth" is sometimes applied to fabrics made in this way.

The mats which most closely approach true woven fabrics in their structure are those which are made in simple chequer-

* Mason, 2, pp. 238-239.

work. When the elements are broad, as in the exhibited mats from the Maldive Islands and from North America, the structure is easily made out. With the employment of finer elements, as in the mats from Samoa, the resemblance to woven cloth may become very close, and as regards the product itself the differences may be very slight (see below).

Although *tapestry-weaving* is a form of technique which is adapted to the production of beautiful fabrics, the fact that the weft is combined with the warp by hand-work, renders it more closely related to mat-making than to true weaving, as far as mechanical technique is concerned.

## WEAVING.

[Wall-cases 35-38.]

The art of weaving, upon which is based one of the most important industries of civilised communities, is practised by races in a relatively low condition of material culture. Compared with basketry and mat-making, however, it is restricted in its distribution, and it is not known to hunting races such as the Andamanese, the Australians, and the Eskimo, nor to many other peoples in higher stages of culture. Outside Europe, Asia, and a large part of Africa, it only occurs sporadically, as, for example, in parts of North and South America. Like so many of the arts referred to in other parts of this handbook, weaving appears to have been known in Europe as early as the Later Stone Age, though it is not certain that the methods employed involved the use of a true loom.

Since the terms "weaving" and "woven" are used in connection with basketry and mat-making, it is necessary to indicate as accurately as possible the nature of the methods and products to which these terms may be more legitimately applied. A basket, a mat, and a piece of woven cloth, may be made up of elements that are interwoven in precisely the same way. In the simplest case, they are made of plain chequer-work. Baskets need not be further considered, since their form at once distinguishes them, but between mats and true woven cloth the differences are not always so obvious. (It should be noted that the word mat is used here with reference to the thin flexible mats of simple construction, and not to such structures as the ordinary coir door-mat or the rug-like mats which are probably more familiar to many people).

In the great majority of instances it is very easy to decide whether a textile should be classed as a mat, or as woven cloth. The constituent strands of the latter are usually finer and softer than are those of the former, and the texture of the fabric is much less coarse. Moreover, cloth is in most cases made of spun fibres, or yarn, whereas the materials employed in the making of mats are strips, splints, or strands which have not been spun. In parts of Africa, and in Santa Cruz and the Caroline Islands in the Pacific, however, unspun plant fibres are woven on true looms, and the so-called "grass-cloths" produced are very similar to fine mats made without a loom. In the grass-cloths the two sets of elements (warp and woof) are at right angles to each other, and the warp strands run in the direction of the length of the piece of material, whilst in mats these relations do not necessarily obtain. An example of the close inter-relationship between mat-making and weaving, is found in the Dumbara "mats" made by the Kinnaras of Ceylon. Warp and weft are of leaf-fibre, but whereas the warp is spun into yarn on a spindle, the

weft is unspun. A true loom, though of primitive type, is employed, but the general appearance of the fabric is that of a mat.

It may be concluded from the above considerations, that there are relatively few cases in which mats and woven cloth are so similar to each other as to present a difficulty in identification.

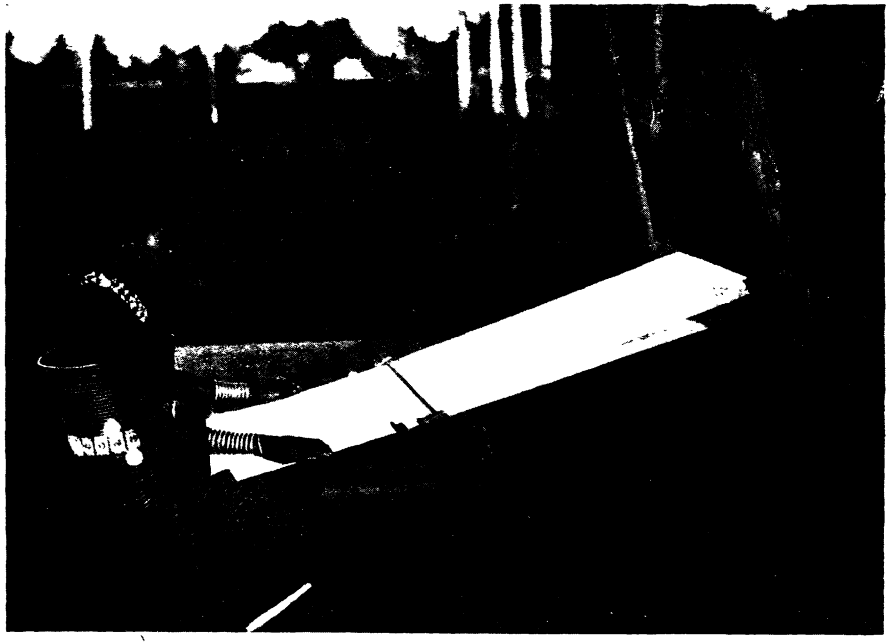
Weaving, in the limited sense of the word, is done by means of an appliance which is called a loom, the origin and evolution of which offer problems of great interest. It can scarcely be doubted that weaving originated in mat-making, and a sufficiently large number of intermediate stages has been preserved in use to make it difficult to draw a sharp line of demarcation between the two processes. For the purposes of classification it appears advisable that the term loom should only be used for such weaving appliances as include some device (of the nature of a heddle, or heald) for shifting the warp strands in sets, so as to avoid the tedious hand-work of taking up each strand separately. An arrangement for stretching the warp in a vertical or horizontal or inclined plane also forms an essential part of a loom, and this may consist merely of two rods or bars, between which the warp is extended in parallel strands. Accessory parts usually occur, and will be described below.

It should be noted that a loom is not necessarily an appliance of large size, nor need it be a fixed piece of apparatus. There are looms for weaving narrow bands (such as the Ainu "ribbon-loom" exhibited), and in many cases the whole loom may be rolled up in small compass between the intervals of work.

### The Loom and its Evolution.

In some of the islands of the Solomon group, in the Pacific, fibre armlets are made on a small frame, consisting of a split stick, the two halves of which are tied together at the ends, and separated from each other in the middle by two struts about 4½ inches long The warp, consisting of a long narrow band of bast, is wound round the frame as a series of parallel strands. The process of weaving consists in passing across the warp, over and under alternate threads, first one way, then back again, and so on, a weft similar to the warp. To aid in this process a slender stick is first threaded across the warp, over and under alternate threads, and remains in position whilst the work proceeds. This stick helps to keep the warp strands parallel, and also facilitates the process of weaving. This is done by hand, without the aid of spool or shuttle, though other small sticks are used to aid the fingers in separating the strands.* Such an appliance as this is not a loom, but it possesses some of the

* See Danneil, p. 231-2.



II.—IBAN (SEA-DYAK) WOMAN WEAVING WITH LOOM LIKE THAT EXHIBITED. SARAWAK, BORNEO.

[Reproduced by kind permission of Dr. Charles Hose.]

features of one. So also do the frames used by the Maori of New Zealand, and the Indians of north-west North America, in the manufacture of their cloth-like mats in twined weaving.

### The Rod-Heald Loom.

The greatest step in the evolution of the loom was made when an arrangement was devised for shifting the whole set of alternate threads by one movement, and thus allowing the weft strand to be passed quickly and easily across the whole width of the warp, when this is narrow, at one thrust of the shuttle (or its equivalent). The looms from Santa Cruz and Borneo, shown in the case, illustrate simple types of loom of this kind. It will be seen that one of the rods which cross the warp has attached to it a number of loops of string. These loops connect the rod with alternate strands of the warp, and by raising the rod* the strands are also raised, so as to make a passage or "shed" for the weft. A weft strand passed through such a shed will obviously run over and under alternate strands of the warp. It is clear that by means of one "rod-heald" only, not more than one set of warp strands can be raised, whereas even for simple chequer-work it is necessary that two sets of alternative strands must be raised in succession. In the looms of the type described this is practically effected by a loose rod (shed-stick), which lies over the strands connected with the heald, and *under* those which are not. By depressing this rod the heald strands are brought below the others, and thus the relative positions of the two sets are altered in such a way as to give a second shed, through which the weft is passed. By the continuation of these processes each weft strand passes from side to side of the warp, and the two sets of elements are interwoven in the simplest manner. It may be observed that an important part in maintaining the parallelism of the warp strands, and in preventing entanglement, is played by the several flat sticks, lease-rods or laze-rods, which cross the warp at some distance from the line at which the work is being done.

Looms similar in principle to those just described are widely distributed at the present day, and the type was formerly in use in civilised countries that have long since discarded it. It may be found in North India, Burma, Japan (Ainu), Philippine Is., Formosa, Borneo, and other islands of Indonesia, and it has spread into the Pacific as far as the Caroline Is. and Santa Cruz. The ancient Mexicans and Peruvians used looms of this type, which still survives in both North and South America ; in some of the South American looms the loops of the heald are not attached to a rod, and if the warp is wide (as in the Lengua blanket loom) the shed can only be made in sections,

* In the case of the Bornean loom the heald has attached to it a second rod so that the former may be raised more evenly.

by grasping and pulling a handful of the loops at once. The rod-heald loom is used in equatorial and northern Africa, and it was employed by the ancient Egyptians and Greeks. Its survival down to recent times in northern Europe and Iceland is evidence of its still wider distribution in former times.

There are two chief varieties of the rod-heald loom, though no difference in principle is involved.

In the one case the warp is horizontal or nearly so, and in the other it is vertical. The specimens exhibited are sufficiently typical of the horizontal loom, which is usually of small size and easily portable. In the vertical loom the warp is attached above to a horizontal bar, and below to a second bar, or to a series of loom-weights, the sides of the frame being formed by upright poles, often stuck in the ground. The vertical looms are less portable than the horizontal, and are employed for larger pieces of cloth. More than one heald may be present if the fabric is to be decorated with woven-in designs.

Amongst the accessory appliances of this kind of loom must be mentioned the *weaver's sword* and the *shuttle*. The former, as its name suggests, is often shaped like the blade of a sword. Its pointed end and its flattened form adapt it for slipping easily into a narrow shed, and by turning it through a right angle its width is brought into play in enlarging the shed for the freer passage of the shuttle. Another important function is the beating down of the weft into position, so that the fabric may be firm and closely woven. (For the *reed*, see below.)

The spool or the shuttle, as the case may be, serves to carry the weft. The spool may be merely a length of stick on which the weft is wound, or it may resemble in form the "shuttle" or "needle" used in net making; occasionally it takes the form of a pointed stick with a nick at the pointed end. The term "shuttle" should perhaps be confined to a combination of spool and carrier, the latter enclosing the spool and its weft.

### The Frame-Heald Loom.

Although the loom with rod-heald was a great advance on the laborious method of shifting the individual warp strands by hand, it was not well fitted for taking part in the progress of mechanical devices for accelerating the rate of working.

As early as the sixteenth century the frame-heald was in use in Europe, and down to the present day this appliance is used in the looms of Europe and Asia.

The frame-heald or frame-heddle is made up of two parallel rods, connected together by a number of thin straight bars, each with an eye in the centre; or the bars may be represented by loops of flexible strands, one set attached to each rod, and each loop connected with the corresponding loop on the other rod in such

a way as to form an eye or *mail* in the centre of the distance between the two rods. The same type of appliance is arrived at in various ways, but the essential feature is the presence of the mails in rigid or flexible strands, which pass from one rod to the other. In the simplest kinds of weaving only one heald may be employed, but as a rule at least two are used. The warp is stretched horizontally, and the healds are suspended from above the warp, with their planes at right angles to its direction. Each warp strand passes through an eye in one of the healds, and between the bars (or loops) of the other. Thus, if a particular strand passes through an eye in the heald nearest the weaver, it will pass between two bars of the other heald, whilst its neighbours on either side will pass through the eye of two bars of the further heald, and between the bars of the nearer one. The healds are so suspended that they can be worked with the feet, usually by means of treadles, and it is arranged that when one goes up the other goes down. As will be realised from the specimens exhibited, the result of working healds in this way is that the warp strands are raised and lowered in sets consisting of alternate strands. In the sheds so produced first one set is uppermost and then the other, and it is clear that by the passage of the weft through these sheds, plain woven material may be made.

The origin of this kind of heald is not known, but it probably arose from the rod-heald. If two rods were used, one above and one below the warp, each with its set of loops, connected with the same set of warp strands, the result would be in all essential respects a heald with central mails as just described.

The weaver's sword is not usually employed in looms of this kind, the weft being beaten home with an appliance called the "reed," or in some cases by a kind of comb. The reed consists of a framework with vertical bars, between which the warp strands pass.

The specimen from West Africa, shown in the case, illustrates the principle of this loom. This example is of very crude construction, and much better looms are used by some tribes. It will be observed that the shuttle is represented by a short stick, and that the fabric is being made from unspun plant fibre. It is possible that this type of loom was introduced into West Africa by the Portuguese in the sixteenth century.

Up to the year 1733, when the *flying shuttle* was invented, European hand-looms did not differ in principle from those which had already been in use for the previous two or three hundred years. The mechanism of the flying shuttle was so arranged that with one motion of the weaver's arm it could be sent across from side to side of the widest warps. The improvements in the hand-loom were not of a fundamental nature

and mainly affected the mechanism for working the healds. These were so numerous in some pattern-weaving looms that it was impossible for the weaver to work them himself, and in the "draw-boy loom" a boy was employed to raise and lower them. Later improvements rendered it possible for the weaver to manage a considerable number of healds himself, up to as many as about fifty. For complex patterns a still greater number of healds was required, and the difficulty was overcome by using, instead of healds of the type described, a number of independent suspended eyes or mails, and the number of possible combinations of sheds thus became very great. The task of tying together the mails for the various combinations was a very difficult and tedious one, but with the invention of the Jacquard loom at the beginning of the nineteenth century, an ingenious method of achieving the same result in a much more rapid and efficient manner rendered it possible for elaborate designs to be woven in the fabric. The ordinary hand-loom with healds is, however, still in use here and there for making relatively simple fabrics.

Whilst advances were being made in the general structure of the hand-loom, the power-loom, originating in inventions by Cartwright in 1785, gradually became so far perfected as to displace the older type for most kinds of work. At the present time the power-loom is a machine of immense efficiency, which works with great rapidity and certainty, and produces woven stuffs of many kinds. Such parts as the healds, shuttles, and the reed are still present, but the work of the weaver consists in tending the machine, ensuring its smooth running, mending broken strands of yarn, etc., and providing for unforeseen accidents. A detailed account of modern weaving methods is beyond the scope of this Handbook. It has only been possible to suggest that, as in other human inventions, the methods and products of civilised man have been derived from those of his remote ancestors, and that these are paralleled by the devices of existing backward races.

The specimens exhibited in this section include complete looms and models, special portions of looms (such as weavers' swords and shuttles), and some examples of woven fabrics. The looms are from Santa Cruz (Pacific Is.), New Mexico, French Congo, Borneo, Japan (Ainu), all these being of the rod-heald type. Of the frame-heald type is a "grass-cloth" horizontal loom from West Africa, and models of hand-looms from Montenegro and our own country.

# THE EVOLUTION OF THE DOMESTIC ARTS

## Part II.

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Numerous original papers on the subjects dealt with in this Handbook will be found in the *Journal of the Royal Anthropological Institute*, in *Man*, in *L'Anthropologie*, and in other periodical publications received at the Museum.

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